THE GEOGRAPHICAL JOURNAL

Vol CXX Part 1 March 1954

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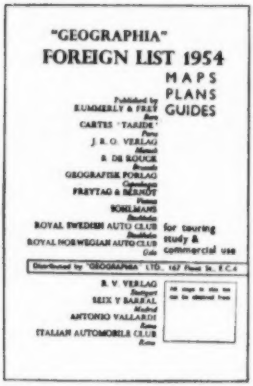
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Monday April 5 *at* 8.15 *p.m.*
ALASKAN ESKIMO PAST AND PRESENT. *By Helge Larsen.*

Monday April 12 *at* 5.30 *p.m.*
CORNWALL. *Kodachrome films with commentary by Professor P. W. Bryan.*

Friday April 23 *at* 5 *p.m.*
SURFACE CURRENTS AND THEIR EFFECTS ON NAVIGATION. *By E. W. Barlow and Commander C. E. N. Frankcom, R.N.R.*

A meeting of the Institute of Navigation.

Monday April 26 *at* 8.15 *p.m.*
MARCO POLO. *An Anniversary Lecture by G. F. Hudson.*

Monday May 3 *at* 5 *p.m.*
NORTHERN SEA ROUTE. *By T. E. Armstrong.*

Monday May 10 *at* 8.15 *p.m.*
EXPLORATION OF ROMAN AND MEDIAEVAL LONDON. *By W. F. Grimes.*

Monday May 17 *at* 5.30 *p.m.*
SAHARA CHALLENGE. *Kodachrome films with commentary by R. St. Barbe Baker.*

Monday May 31 *at* 8.15 *p.m.*
EASTER ISLAND. *By Sir Harry Luke.*

Friday June 4 *at* 8.15 *p.m.*
EXPLORING THE OCEAN BED. *By Bruno Vailati.*

A joint meeting with the Institute of Navigation to hear the leader of the Italian Underwater Expedition to the Red Sea.

Monday June 14 *at* 5 *p.m.*
ASPECTS OF MEDIAEVAL SURVEY. *By Derek J. Price.* (*Provisional.*)

Monday June 21
ANNUAL GENERAL MEETING at 3 p.m.

ANNUAL DINNER

The Annual Dinner of the Society will be held on the evening of Monday June 21, at the Hyde Park Hotel, at 7.30 for 7.45 p.m. Evening Dress with Decorations. Tickets; two pounds five shillings, including red and white wine. *Applications for tickets* for Fellows and guests should be made in writing and should be sent with remittance and names of guests to the Honorary Secretaries, to arrive in any event not later than June 5. But since attendance will be limited to 250, tickets will be allotted in order of receipt of applications. Applications should therefore be sent in as soon as possible.

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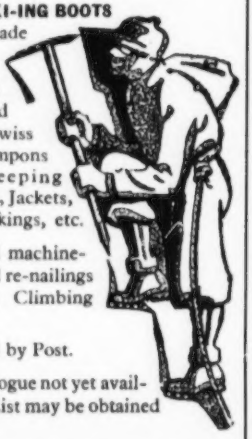

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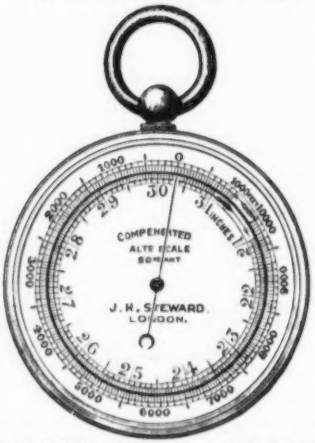

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David Livingstone in middle age

From "The last journals of Livingstone," ed. H. Waller (John Murray, 1874)

The
GEOGRAPHICAL JOURNAL

Vol CXX Part 1 *March 1954*

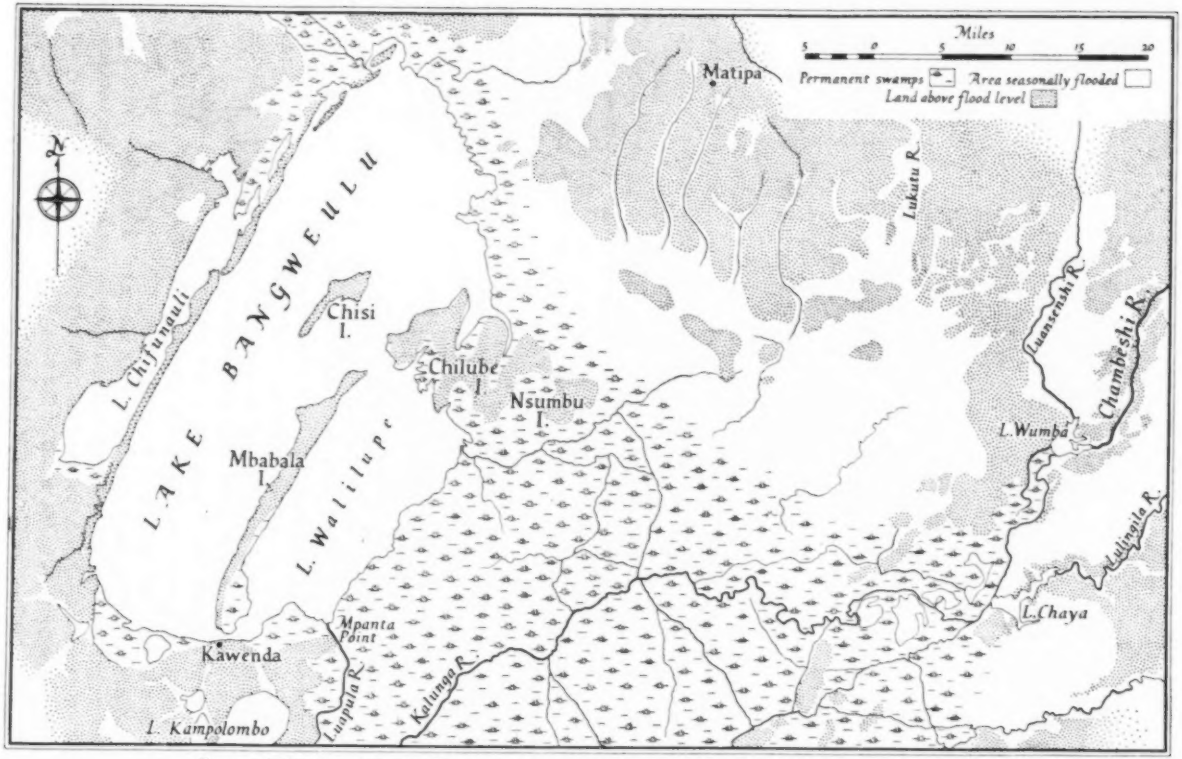
NEW LIGHT ON LIVINGSTONE'S LAST JOURNEY

PROFESSOR FRANK DEBENHAM

THERE HAS ALWAYS been a mystery about the last few weeks of David Livingstone's life, when he made a change of plan which hastened his death; a decision which, judging from his own diary, was against his better judgement.

On his last journey, when he had parted from Stanley, resisting the latter's appeal to accompany him to England to recuperate his health, this strange, lonely man set out once more "to make a complete work of the exploration of the sources of the Nile." With a party of people he approached the vast area of the "Bangweolo" Swamps (see map on page 2) from the north, purposing to get to its southern side by any practicable means. It was in the middle of the rainy season and the party was entangled and even lost in the maze of swamps for several weeks before, on an island in the main swamps, they reached Chief Matipa with whom Livingstone had made an arrangement by messenger some days before to let them have canoes in which to carry the party to the south side of the Lake itself, "for five coils of brass wire." However, at his first interview with the chief, he was persuaded to abandon the route across the lake and to go through the swamps to the east which we now know to be a far longer and more difficult journey. And so began that last weary march of nearly six weeks which ended in his death near the Lulimala River. Now why did he think it was a shorter journey and make the fatal decision to go east rather than south-west from Matipa's island?

Recent research into Livingstone's own maps and his copious note-books of navigation figures seems to provide the answer. The map reproduced facing page 4 is from the 'Last Journals,' and it was compiled in 1874 from these original documents. In it we see Matipa's island or "Mosumba" marked at at the eastern end of the over large Lake Bangweulu, not far from the entrance of the "Chambeze" into the lake, and certainly well on the way towards his goal, the mountains to the south of the lake. This map or something like it must have been Livingstone's guide in making his decision, for in it Matipa's island appears to be about 80 miles to the east of the island of "Chiribe."



Part of the Bangweulu Swamp, from 1 : 350,000 map D.C.S. (Misc.) 64, 1952

which he had seen and plotted on his first visit to Bangweulu five years before. The tragedy is that Matipa's Island is *not* at the eastern end of the swamps but only 4 miles from Chilubi Island and near the western end. From Chilubi Island it is at most a two days' journey down the lake to the "Kabendé" which, in the first case, was his aim, and only four or five days to the south of the whole swamp area. It is the object of this paper to try to discover how this fatal error in longitude arose.

Dr. Livingstone was perhaps the most exact surveyor and navigator in Africa at that time, and we shall find that this error was due to a tale of misfortunes piling up simultaneously in which cloudy weather, desertion of his followers, accidents to his chronometers and sextants and a steady deterioration in his health were all involved. On this journey he took three chronometers and two sextants, and his technique of navigation was the best if not the only one then available to an explorer by land. Briefly, it was to get his latitudes by meridian passage of star or sun, observed with sextant and artificial horizon, and dependent only on his Nautical Almanac. Accordingly, we find his latitudes rarely differ by more than a mile or two from those of our modern maps. For longitude his method was that known as "lunar distances" in which the observations are the angular distance from the moon, of the sun by day or a star by night, and the altitudes of the two above the horizon. Provided that his chronometers were giving him approximate Greenwich mean time his skilled observing would give him his longitude with no greater error than 10 or 20 miles. Accidents to his chronometer and long periods without observations could magnify these errors very easily to 30 or 40 miles east or west of the true position.

It was in the dry season of 1867 that Livingstone discovered Lake Bangweulu. He had then been over a year on his way from Mikindani on the East Coast, his party had dwindled to nine men and he found that he had to depend on the protection of the Arab slavers and traders who were already active around the southern end of Lake Tanganyika. Their goodwill was gained and without it he could never have made his discoveries. On the tedious way up from Lake Nyasa his longitudes were steadily in error to the east by about 20 miles, but he records an earthquake near Lake Tanganyika which affected his chronometers. Possibly for this reason his error when he reached Lake Mweru was in the opposite direction, 20 miles to the west.

His Arab friends were not interested in what they heard of Lake Bangweulu, so Livingstone had to journey there with but four of his party, the remainder refusing to go. The lack of assistance hampered him badly and may have been part cause of his longitude observations becoming more and more westerly, till they were 40 miles out when he reached the Lake, and this error was to help in his undoing on his next visit.

His sudden decision to make this dash for the lake with a small party was probably connected with an entry in his journal a few days before he started: "If I am not deceived by the information I have received from various reliable sources, the springs of the Nile rise between 9° and 10° south latitude, or at least 400 or 500 miles south of the south end of Speke's Lake, Victoria Nyanza, which he considered to be the sources of the Nile." This entry is the

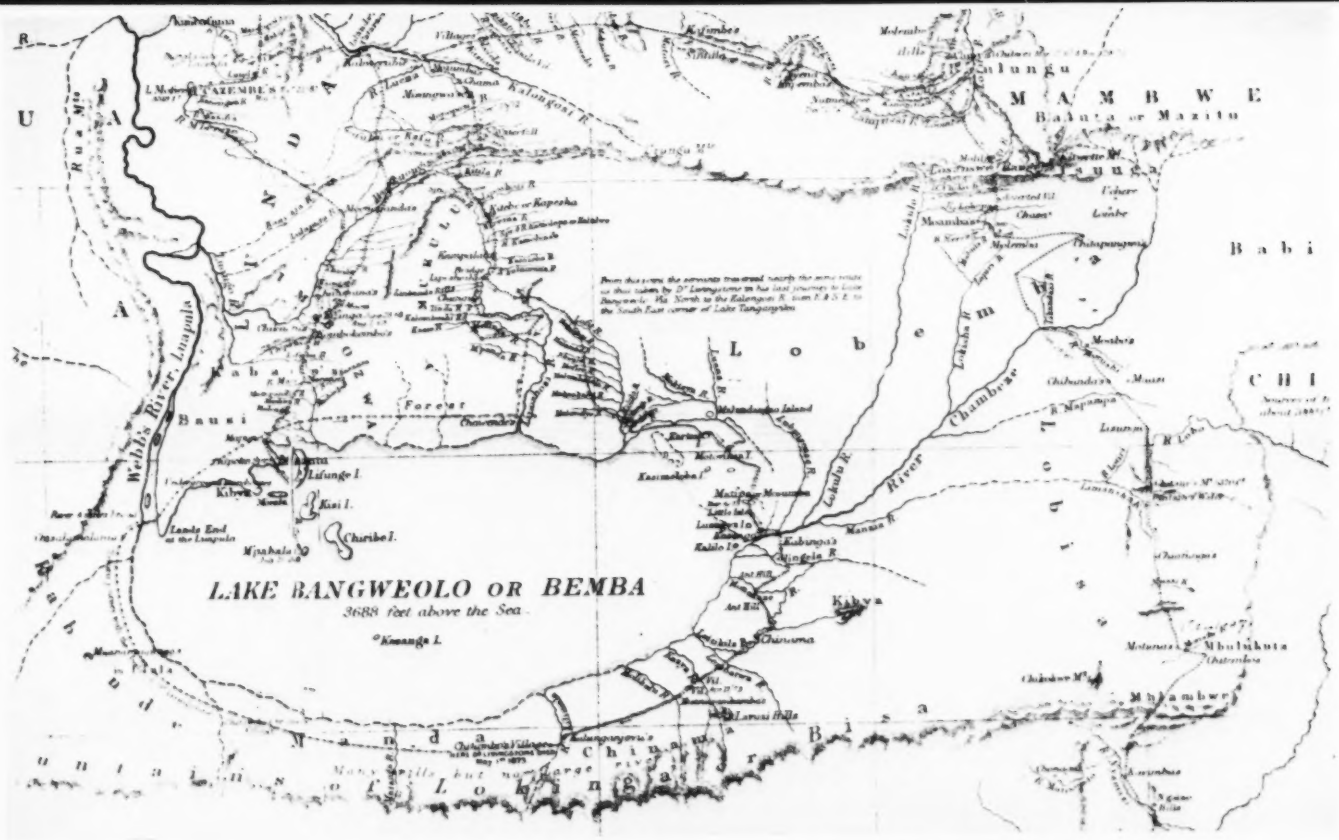
first positive appearance of a belief in Livingstone's mind which ultimately became an obsession. The details of this journey need not detain us beyond noting what he saw at the Lake itself, which he crossed in a very large canoe to Mbabala Island. What he saw and described from that point is of melancholy significance because though it was carefully mapped it was all so far to the west that on his final visit he apparently did not recognize he was near his former route. The large island of Chilubi was quite close, and he probably saw also the island beyond and nearly attached to it, called Nsumbu, where three years later he met Matipa.

A most interesting entry in the diary is: "The mainland to the south of Mbabala is called Kabendé." He may have been able to see it from his central position since it is marked by the 40-foot terrace at Mpanta Point. Three years later, when he was only 12 miles to the east of Mbabala, but without knowing it, he discussed with Matipa going to this Kabendé by canoe but rejected that sound plan for reasons that we are trying to discover.

We have no space to follow his return route, nor his journeys into the Manyuema country until the famous meeting with H. M. Stanley in October 1871. During this time his conviction grew stronger that the real source of the Nile lay to the south of his position and that the Lualaba, which he knew to be the continuation of the Chambeshi and the Luapula, was the Nile itself.

We now take up the tale at the point when Dr. Livingstone made his decision to remain in Africa in spite of Stanley's urgings. An entry in his diary on 18 August 1870, when he was far inside the present Belgian Congo in part explains this decision. He had just met two men who had been far to the south to the copper mines of Katanga and beyond, and as usual he extracted as much geographical information as he could from them. Their description of four "fountains," or river sources, excited his attention, and he cautiously connected it with "the story told to Herodotus by the secretary of Minerva in the city of Sais." As time went on he became less cautious about this fancied resemblance to Herodotus's guess as to the source of the Nile. Therefore we are not taken completely by surprise when in February 1872 he gives his plan for his next exploration, noting that: "It is all but certain that four full-grown gushing fountains rise on the watershed eight days south of Katanga, each of which at no great distance off becomes a large river; and two rivers thus formed flow north to Egypt, the other two south. . . . I propose to go round south of Lake Bangweolo and due west to the ancient fountains. . . . This route will serve to certify that no other sources of the Nile can come from the south without being seen by me." He even entered these four fountains on the map he sent back with Stanley, naming them after friends and supporters.

Restored both physically and mentally by the contact with Stanley, and re-equipped from that traveller's ample stock of stores, Livingstone started off on this last journey, after he had waited for fifty-seven men from the coast, at the end of August 1872. By November he had reached his former track at the south end of Lake Tanganyika. He had decided to approach Lake Bangweulu from the north once more, hoping no doubt to cross it more easily than to walk round the eastern boundary to his goal. He crossed the Kalungwishi only a short distance above the point at which he met it on his return



Part of the map of Central Africa compiled from Livingstone's surveys during his journeys in Africa, 1866–1873

From 'The last journals of Livingstone,' ed. H. Waller (John Murray, 1874)

from the lake in 1868, in fact quite close to the present pontoon-crossing on the road from Kawambwa to Mporokoso. His map so far is as correct as could be expected, indeed the longitude of the crossing point agrees with the modern map almost exactly.

When he crossed the Kalungwishi on December 19, rain was one of his difficulties and another was that the local chief, Chama, was unfriendly and endeavoured to send the visitors off in the wrong direction. Livingstone coped with the distrust of the local people by being firm, but the swollen streams were a great problem. He mentions "a sedgy stream which we could barely cross. We hauled a cow across bodily." Livingstone never uses the local word for these marshes, namely *dambo*, but has a delightful collection of descriptive names for them such as "sponge," "soak," "ooze" and the Swahili *bouga*.

His party climbed the comparatively slow ascent to the Chimpili line of hills which marks the divide between the streams draining to Lake Mweru and to Bangweulu. In the next few days he crossed first the "Lopopussi" and then the "Lofubu," and avoided the confusion that would have overtaken a lesser man when he passed over the height of land to two other rivers of precisely the same names but running down to the swamp area.

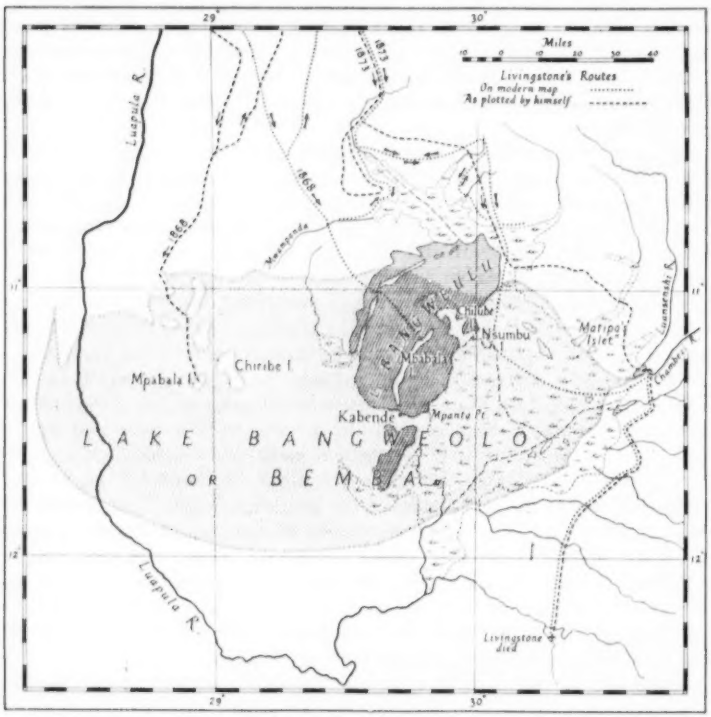
The persistently cloudy weather at this time was a dire misfortune since a reasonable longitude in the next week or so might have been of vital assistance. In fact, the first observation for longitude does not occur until February 3. On January 4 he descended slightly towards the Lupososhi, and from this point we can follow his route very closely on the modern part of the map on page 6. He seems to have crossed the stream, 30 feet wide and breast deep, close to the point where the present main road crosses it going from Fort Rosebery to Luwingu. Here he met a minor chief named Kapesha, who provided guides to the major chief of the district, Chungu. They continued down the left bank of the Lupososhi, passing many small but flooded streams which are difficult to identify, and by January 9 Livingstone turned west to cross the Lupososhi by a bridge 45 feet long. He was approaching Chungu's headquarters village, but that wily chief was afraid and quite sure that "we should put his head on a pole like Casembe's," who had fallen a victim to the Arab slavers and traders the year before.

Illness and vexatious delays always brought his obsession about the Nile to the fore and so we find him writing on January 11: "Cold and rainy weather, never saw the like; but this is among the sponges of the Nile and near the northern shores of Bangweolo."

He never met Chungu, but purchased food from his people. As the map shows, he was now on the western side of the long wide marshes of the Lupososhi, and veering more than he liked, probably, towards the west. We can follow his route fairly closely by the help of local tradition; for instance, Mr. Greenall, recent District Commissioner at Luwingu, consulted a local elder in this district, Kapapele by name, whose forebears had told him that Bwana Ngeleshi (as Livingstone was called) had visited this and that village on his way to Chungu.

He was now in the latitude where the features on his map made on the former journey were some 30 or 40 miles too far to the west and this may have

misled him when he reached the estuary of the Mwampanda River. He does not mention in the diary that this was the very river he had crossed before on his way to the Lake. It seems to us now as a bitter freak of fate that made him turn back when he was within a bare 4 miles of his earlier crossing place. The river, swollen with the rains, was unfordable, and he marched back on his tracks, furious with Chungu, of whom he writes: "We were scurvily treated by Chungu. He knew that we were near the Chambeze, but hid the



Comparison of Livingstone's Lake Bangweolo with a later map. (*G.S.G.S. 2465, 1 : 1,000,000, Lake Nyasa sheet, 1946*)

knowledge and himself too. It is terror of guns." One hesitates to criticize the actions of so great a traveller, when worn out by fevers and the bad weather, but it is clear in the light of our present knowledge that Chungu, when Livingstone asked the way to the south of the lake and swamps, could have done no other than direct him down the west side of the whole swamp area, which was the nearest way.

This "terror of guns" was constantly to be the party's undoing during the next few weeks. They wished to cross the Lupososhi by canoes, but had much difficulty in negotiating for them and then found they were all too

small for the donkey. This attempted short cut was presumably in the vicinity of the present Kamfumu, where there is now a native ferry. So the party had to toil back to the ford of the Lupososhi (the bridge not being mentioned on this occasion), and thence down the left bank of its marshy course.

Continued bad weather evokes the despairing note of January 22: "No astronomical observations worth naming during December and January; impossible to take any, owing to clouds and rain. It is trying beyond measure to be baffled by the natives lying and misleading us wherever they can." And on the next day he is forced to write in his diary: "I don't know where we are, and the people are deceitful in their statements, unaccountably so, though we deal fairly and kindly."

They repaired a bridge over the Lufubu and crossed; after this we come to a curious entry showing that he was sufficiently aware of his position to choose the best route but too ill perhaps to insist upon taking it. He says: "I arranged to go to our next river, Luena; but another plan was formed by night, and we were requested to go down the Loou. Not wishing to appear overbearing, I consented. . . ." This is most unlike the Livingstone of four years earlier, and on the very next day he remarks on a heavy attack of dysentery with loss of blood.

From the bridge therefore the party headed more or less directly for the nearest point of the lake, and camped three days later, probably on the Bwela stream, which is about 4 miles from the swamp and 7 miles from the open water. From here he sent out scouts, one of whom saw the lake and two islets. The scouts, however, did not come across a single soul and were forced to return on account of hunger. There must have been some bad luck or faintheartedness about this scouting, as all the northern shore has villages along it and Livingstone was told later that he had been close to these settlements. In his weak state the Doctor accepted the reports of the scouts and turned back for "four hard days' travel to Chitūnkue's." He was going back for both food and guides. Though he writes that he felt at the mercy of the chief, he found him much more kindly disposed than he expected. Livingstone describes him as a "fine jolly-looking man, of a European cast of countenance, and very sensible and friendly." He told Livingstone that he had been quite close to Matipa, he even showed them two of Matipa's men who had heard them firing guns, and he offered them two guides. Livingstone's illness and impatience must have been responsible for his next entry, "We have lost half a month by this wandering, but it was all owing to the unfriendliness of some and the fears of all."

It was during his stay here for four days that we find the entry in his diary for February 5, "I got lunars, for a wonder," and he was able to get another set of lunars on February 6. But the result when worked out was manifestly wrong, putting him much too far to the east. He must have been sorely puzzled though there is no mention of it in his diary, but on the pages of his navigation book there are two interesting notes which were written in two months later. They are as follows:

"Page of observations: 4th Feb. Note: something went wrong in the silvering of the large reflector of sextant and it was only at the confluence of

Chambeze that I succeeded in correcting it." And on February 6: "A large error crept in by a change in the silvering of the reflector—corrected only at Chambeze confluence. Two images appeared, one a long way horizontally from the other."

The net result in his mind must have been that though uneasy about his longitude he considered it was an error in the right direction, and that he was farther east than we now know him to have been at this time.

After four days' stay in this friendly atmosphere Livingstone started off again, and reached the repaired bridge on the Lufubu in a day and a half—a distance of some 25 miles. From this point the guides took him, apparently in a straight line, in the direction of the estuary of the Luena River. Three days from the bridge he says that they came within sight of the Luena and the lake, but he found that the guides were now "more at a loss than we are, as they always go in canoes in the flat rivers and rivulets."

So once more the party were more or less lost. Livingstone sent on two men to find one of Matipa's villages in order to get canoes to navigate the lake or a guide "to go east to the Chambeze, to go round on foot." This wording in itself shows that at the time he thought that he was much nearer the eastern end than the western. Similarly, two days later, when he had still failed to contact Matipa's men, he says he is sending a message "with a request to Matipa to convey us west if he has canoes but if not to tell us truly and we will go east and cross the Chambeze where it is small."

He arrived somewhere near the banks of the Luena Estuary on February 13 and it was not till March 1 that he finally embarked on the journey to Matipa. The very "uncomfortable spot" where he was on February 19 would appear to be well up the Luena Estuary, since from that camp he was "carried three miles to a canoe and went westward, in branches of the Luena, very deep and flowing west for three hours." Three hours in a canoe, even without a regular channel, should have taken him between 4 and 6 miles: I would suggest therefore that he camped somewhere near the swampy mouth of the Lelangwa. There seems no doubt that the point of embarkation in Matipa's canoes was about 5 miles east of Nsombu, at the present-day village of Chitunkubwe, from which he would go down the Matuku channel towards the lake.

Meanwhile he had sent men to communicate with Matipa whom he thought would be on the "Chirube" Island he knew and on February 26 the trustworthy Susi returned: "With good news from Matipa, who declares his willingness to carry us to Kabendé for the five bundles of brass wire I offered. It is not on Chirube, but amid the swamps of the mainland on the Lake's north side."

He means that Matipa is not on "Chirube," but on a distant island far from it. Kabendé was marked on his map made on his first visit as an area to the south and west of the lake proper. It was really an important village at the south end of the lake opposite the terminus of the long Mbabala Island.

There is every reason to believe that the channel was the same as that used today. It passes by the large, sandy, densely-wooded island called Mushitu Wa Mulanda, much frequented by the fishermen for the long stiff stems of the Chiwale palm which they use as punt-poles. This would appear to be what

Livingstone calls on his map "Malandangao Island." His party did not land on it but went on to the small Kafinsa group, low sandy islands just inside the edge of the reeds and therefore not on the lake itself. Here he found people drying fish over fires, just as they do to this day. Livingstone calls the islet "Motovinza," and one cannot identify this absolutely since there are no less than thirteen low sandy islets, each with its fishing-camp, along the route to Chilubi Island.

From this resting-place it took seven-and-a-half hours' punting to reach the chief Matipa, who was then living on Nsumbu Island. This is separated from the much larger Chilubi Island by a mile of deep water and permanent swamp known generally as the Molonga Channel. His estimate of distance from his starting-point as 30 miles is not really very far out, for by the shortest route 25 would be a fair estimate.

The route in the dry season would have taken him past the north-east end of Chilubi Island, but in the floods his guides would probably have taken a short cut over the "prairie"; even so it seems extraordinary that he should not have had a glimpse of the large island. This introduces us to the great problem of whether he ever realized that he was but a mile or two from the large island he had viewed in 1868 and described as: "Chirubi is the largest of the islands and contains a large population, possessing many sheep and goats." Further, he knew that it was only a two-day journey at most from Chilubi to the Kabendé he sought. I have camped on the identical spot where he used the mosquito net shown in his book, and it is dry, sandy, and well away from the very large *mushitu*, or clump of dense vegetation, which still overpowers the village. A walk of about 2 miles from his camp would have enabled him to see the large island of Chilubi only 4 miles to the west, and his omission to mention that island seems to be proof that in his weak state he did not take that walk. He did in fact stay three weeks owing to delays in securing canoes but not once in his diary does the name "Chirubi Island" appear.

The day after reaching Matipa's village he calls on him and a change of plan is decided upon. There is an important passage in his diary here on March 3 which must be quoted in full: "Matipa says that five sangos or coils (of wire) will do to take us to Kabendé, and I sincerely hope that they will. . . . I visited Matipa at noon. He is an old man, slow of tongue, and self possessed; he recommended our crossing to the south bank of the Lake to his brother, who has plenty of cattle and to go along that side where there are few rivers and plenty to eat. Kabendé's land was lately overrun by Banyamwesi, who now inhabit that country, but as yet have no food to sell."

Matipa thus dissuades him from his former plan and it is hard to understand why he does so, unless it was in order to enable his brother to share in the cloths or coils of wire of the strange white man. Then comes an illuminating sentence in the diary—"I am rather in a difficulty, as I fear I must give the five coils for a much shorter task," another indication that Dr. Livingstone believed he was near the eastern end of the swamps.

Whether he knew that at Matipa's he was not many hours canoe journey from the Kabendé that had been his first choice will perhaps never be known for certain. Mr. Horace Waller, the editor of the 'Last Journals,' after

conversation with Susi and Chuma, produced an interesting footnote on this point: "The men say that the actual deep-water Lake lay away to their right—when coming from the north to Matipa's—and, on being asked why Dr. Livingstone did not make a short cut across to the southern shore, they explain that the canoes would not live for an hour on the lake but were merely suited for punting about over the flooded land." Livingstone himself knew that larger canoes could be had, as he had used such three years before, and in any case the course to Kabendé is not over the open lake but along its swampy edge, so that reason by itself is not sufficient to explain the Doctor's change of plan. As given in the diary, the wording of Matipa's advice is curious since his brother's village "at the Chambeze mouth" can hardly be said to be on the south bank of the lake though Kabendé would be correctly so described. Similarly the phrase "where there are few rivers and plenty to eat" would fit Kabendé well. Earlier commentators, such as Mr. J. E. Hughes in his excellent book, 'Eighteen years on Lake Bangweulu,' have interpreted this passage to mean that it was Matipa who was urging the Kabendé route and Livingstone who rejected it. In a spirited passage in his book Hughes says:

"This Kawendi is the Kabendi mentioned by Livingstone in his diary, February 26th, 1873. The Chief Matipa of Chiruwi had offered to send him through to there on payment of five bundles of brass wire. Matipa was telling the truth for once; it would have been the very thing. Livingstone would then have had open water to Mbabala Island, a good footpath down that island, then after crossing a narrow channel, a firm, well wooded mainland, thus avoiding all the swamps in which he so soon met his fate."

That night he gets a latitude by star which works out at 11° 11′ S., which is correct. On the same page there is a "lunar" for longitude, worked out to give 31° 3′ E., which is 60 miles too far east. Moreover it is 120 miles east of the position of "Chirube" Island on the map plotted from his first visit. He must have had suspicions about this figure, for on March 5 there is the entry in his diary: "The real name of this island is Masumbo, and the position may be probably long. 31° 3′; lat. 10° 11′ S." There is a misquoting here for the latitude, but the significant words are the cautious "may be probably."

He was clearly ill at ease over this figure and on March 5 he spends a solid two hours taking more "lunars." The results are more discomforting than ever, and are put down in his note-book:

	31	10
	32	3
	31	42
Mean	31°	38′

followed by the remark, "Matipa's all wrong."

My own interpretation is that this means "(The above figure for) Matipa's islet (is) all wrong," but it could conceivably mean: "Matipa, the chief, is all wrong," which is rather meaningless unless he had been arguing with the

chief about where he was. On March 21, still at Nsumbu Island he gets another set of lunars, heading the page with: "Matipa islet=Mosumba;" but the result is more mystifying than ever, giving a longitude of 29° 12′ E. He has criss-crossed the page with pencil lines as though to show that he discarded the whole observation, and on the next day begins another set but the figures trail off with the remark: "Clouds obscure all:" and underneath it "Sextant erroneous." On the last day before he left he tries again but the result is to put him further east than ever and the workings conclude with the terse remark, "Sextant in error."

Meanwhile the slackening of the rainy season—they had nine days without rain—and the rest seemed to have benefited Dr. Livingstone who says nothing of his state of health during his stay. But his diary is rather piecemeal at this time and he may have been ill and unable to write clearly except over minor matters such as the arrival of the donkey by canoe, the local fish or how his people made bread.

He accuses Matipa of "playing the villain," presumably because he promised canoes which were not forthcoming, so he "made a demonstration by taking quiet possession of the chief's village and house; fired a pistol through the roof; Matipa fled to another village." The effect was instantaneous for within an hour three canoes were produced and he got the valiant Susi off with a party of twenty men to the east to the "Chambeze." Susi returned on March 23 and the Doctor himself embarked the next day. The party "punted six hours to a miserably small islet without a tree"; and since this route is the normal one for crossing the northern end of the swamp they probably went at about three miles per hour, which is an average rate for punting in those waters. The "little islet" was Cherongo, a patch of sand still used as a temporary halt. Livingstone recognized that a good part of this traverse was what he called "prairie," that is, with grasses, showing that in the dry season it would be no longer swamp. The next day, "After another six hours punting, over the same wearisome prairie or *bouga*, we heard the merry voices of children." This was on the small island of Kansenga, where they slept, having passed the large island of Luangwa.

The next day they had some trouble, which is not fully explained, in crossing one of the ana-branches of the Chambeshi. These branches run fairly fast, but not dangerously so. One presumes that the trouble was due to a leak in the canoe rather than to turbulent water. The tale of the loss was a slave-girl belonging to one of his men and the donkey's saddle; the ammunition also sank, but was fished up. From Livingstone's description of the crossing it is possible to recognize where it took place—namely, at the mouth of Lake Wumba, which is the real junction of the Luansenshi with the Chambeshi. Livingstone was much impressed by the size of the two rivers. The camp seems to have been formed on the slightly higher land on or near the shores of Lake Chaya. That he does not mention the lake as such might be because at that flood time it would be difficult to recognize it as a lake.

He sent the canoes back again to Matipa for the remainder of the party, about twenty men, and the weather improved sufficiently for him to take more "lunars" on April 2 and 3. At the conclusion of the working out he writes "sextant corrected" which presumably means that he had got rid of

the double image he referred to earlier. The mean of his four observations was 29° 27′ E., which was reasonable compared to those of a month earlier, though about 50 miles west of the modern figure. It will be recalled that on his first visit to Lake Bangweulu his longitudes were 30 or 40 miles too far west and the figure he had now got would at least harmonize with the map he was carrying.

This was three days after the heavy haemorrhages had started which culminated in his death a month later, yet we can imagine that as he put away his sextant for almost the last time he felt relieved at having put it right and probably looked forward to clearing up the confusion of his earlier sights when he got home to England.

The rainy season was now over and the floods had passed their peak so discretion must have advised their staying at this camp by Lake Chaya for a few weeks. Whether it was his feeling that he must hurry while life lasted or whether impatience was a consequence of his disease, he decided to push on as soon as he had his party complete. Two days later an entry in his diary shows the strength of his conviction as to where he was. Describing the scene as he saw it from his canoe he writes: "It is all water, water everywhere . . . the amount of water spread out over the country constantly excites my wonder; it is prodigious . . . it is the Nile apparently enacting its inundations, even at its sources."

We need not follow the party on its last sad month of toiling across the swamps, Livingstone getting weaker every day until he has to be carried on an improvised stretcher or *kitanda*. To my mind the saddest incident of all is one which brings vividly before us the desperate hope of this indomitable man that the end of his search was near, a search that by then had, for him, taken on the guise of a quest for the Holy Grail.

Two days before the last brief entry in his diary, so Susi told Dr. Waller, they were resting in a village and the Doctor had the chief men of the village brought to him, lying on the *kitanda* under a tree. "They were asked whether they knew of a hill on which four rivers took their rise. The spokesman answered that they had no knowledge of it."

So disappointment was to remain with him to the very last.

(The text of the above paper is based on the spoken address given by Professor Debenham at the Evening Meeting of 23 November 1953 which resulted in the following discussion.—*Ed. G.J.*)

DISCUSSION

Evening Meeting, 23 November 1953

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: To-night we welcome a very old friend of the Society, Professor Debenham, who will speak to us about David Livingstone.

Professor Debenham then read his paper

The PRESIDENT: We have with us Dr. Macnair from whom we should like to hear a word or two.

The Rev. J. I. MACNAIR (Chairman, Committee of Management, Scottish National Memorial to David Livingstone, Blantyre): I consider it a great honour to be asked to represent the Livingstone Memorial. We have had a number of contacts with the Royal Geographical Society and have had generous treatment from you. You lent us last year part of the tree under which Livingstone's heart was buried. We had it on exhibition and it attracted much attention.

The Royal Geographical Society and the London Missionary Society were the two bodies which led Livingstone to fame, and though he had a critical word for your Society now and again, he was grateful for your assistance. He thought the Society niggardly in its financial support—I know that is not characteristic of it—in that it gave him only £500 towards that last expedition of his and if it had not been for his good friends, Young and Murchison, that expedition would never have happened.

You probably know that much of this evening's lecture was drawn from material at Blantyre, but you may not know that the actual research was done by the lecturer in my study in Edinburgh. The little notebook Professor Debenham showed you, given by our Society to your Society a little while ago, is full of mysterious hieroglyphics which none of us could understand. I now perceive it to be a book of the greatest value. It has been given to the Royal Geographical Society; and we will not ask it back!

My real reason for rising is to say a little about the Livingstone Memorial and the way in which its large mass of material came into the keeping of our Trust. The Scots as a people are proud of their great men, and Livingstone has always been almost worshipped. But, by a strange omission, we forgot about his village birthplace and his house. Thirty years ago that birthplace was a slum in a condemned area—a disgrace to Scotland. But now we have in Blantyre perhaps one of the most impressive memorials to be found anywhere.

Sixty to seventy thousand people visit the Livingstone Memorial each year and they come from all over the world. Increasingly it has become a place of pilgrimage for young African men, of whom there are a great many in Edinburgh and Glasgow. At Blantyre those young men see things they will never see again, among them, a collection of slave apparatus, generously given the Trust by the Anti-Slavery Society. We recently had a visit from one of the members of the family of the Paramount Chief of Basutoland who had come on pilgrimage to the Livingstone shrine, because he considered that David Livingstone was the greatest man who ever lived.

One may safely say that there is not a more complete and interesting group of personal relics anywhere in the world, and they were not collected: they collected themselves. As soon as it was known that my Committee would be able to take charge of such things, a stream flowed in and has continued to flow up to the present day, until we cannot easily find a place for them. Every one of the relics has been given, not one bought.

One forenoon there was handed into my house a tin travelling trunk in a somewhat battered condition; the lock had burst, it was tied up roughly with rope. When I opened it, you may judge my amazement when I found it completely packed with Livingstone material; there was hardly anything that was not in his characteristic handwriting. There were many valuable autograph maps, there were the notebooks, the whole box was filled with treasures. There was no message, no word with it and no receipt asked for, and from me, a Scotsman! We knew where it came from: it came from one of the branches of the Livingstone family, and it had lain for seventy years in an attic in Edinburgh, untouched. Amongst that immense mass of valuable material I found

fourteen little books of which we have given your Society one. These books contain practically all we know of that last journey by David Livingstone.

I want very warmly to invite you who live in the south to come to Blantyre and see what you can learn from the Memorial. It is more frequented than any other personal shrine in Scotland, and you will get more than a thrill out of it if you come in the right spirit: you will get an experience, maybe a deep spiritual experience.

May I conclude by relating a little incident which seems germane to the lecture. Livingstone was an extraordinarily simple man; very uncomplicated. Years ago I heard in Blantyre this little story. There was an old man there who knew the two Livingstone lads, as he said, "verra weel" and he said that there was a queer difference between the " twa boys." If they were going along the road and they came to a puddle David's brother walked "roond it but David he stamped stracht through"—he stamped stracht through to the end, as we have seen. That is part of the reason for Professor Debenham's talk. Once Livingstone had made up his mind, it was nigh impossible to get him to change it. He probably suspected he was on the wrong track in this Nile business and he could not stand it; he made up his mind to do it, and he stamped stracht through to the end.

Mr. J. WALLACE (Commissioner for Northern Rhodesia): My part in the proceedings is extremely brief: to propose the vote of thanks to Professor Debenham for his most interesting lecture. I first fell under Professor Debenham's spell more years ago than I care to remember, and having spent twenty-five years in Northern Rhodesia I could wish he had come in those days to lecture to us on the lines of his lecture this evening rather than on some of the—at least to me—obnoxious subjects which he did choose. He was born in Australia, although I believe his forbears hailed from the flat-lands of Suffolk. That is why he feels so much at home in the Bangweulu swamps. Indeed, I think he is hoping he may return there once again to do a memoir. We hope that visit will materialize.

Dr. Macnair asked you to visit the Livingstone Memorial in Scotland. I would like to interest you in something farther afield. I hope those of you who still have the energy and initiative to go to Rhodesia will, if the opportunity offers—and the younger ones among you can certainly make it—go there to see what a legacy Livingstone and his successor, Rhodes, left to this country.

May I ask Sir John Waddington under whom I served for many years in Rhodesia to add one or two words of thanks?

Sir JOHN WADDINGTON: I am very glad indeed to second the vote of thanks to our lecturer. I was privileged to have many contacts with Professor Debenham when he was in Northern Rhodesia making a study of Lake Bangweulu. At that time he was primarily concerned with an examination of water levels and river currents, a subject on which he is a great expert. But, as you will have seen from the map, he was on the scene of Livingstone's last journey and I felt at the time that he was determined to return and concentrate on a study of Livingstone's last days. We are all delighted that he decided to do so.

UNVEILING OF THE LIVINGSTONE STATUTE

THE BRONZE STATUE of David Livingstone, placed on the north side of the Society's Hall, was unveiled by the Secretary of State for the Colonies (Mr. Oliver Lyttelton) on Friday, 23 October 1953. Prior to the unveiling ceremony the Secretary of State was received by the President of the Society (Mr. J. M. Wordie), Dr. Hindle, Dr. Briault, General Sir James Marshall Cornwall, Mr. Leonard Brooks, Mr. T. B. Huxley-Jones and the Director and Secretary (Mr. L. P. Kirwan).

The party proceeded to the Hall, the President took the chair, and with him on the platform were the Secretary of State for the Colonies, Dr. Hubert Wilson, the General Secretary of the London Missionary Society (The Rev. Maxwell O. Janes) and Mr. T. B. Huxley-Jones.

The PRESIDENT, in opening the proceedings, said:

I should like this afternoon, by way of introduction, to speak about Livingstone's connection with our Society, and more particularly of his association and friendship with our great President, Sir Roderick Murchison.

Livingstone landed in Africa for the first time in 1840 and during the next ten years of what may be called his purely missionary period he undertook numerous journeys, many of them of more than 600 miles. On one of these, in 1842, travelling northwards he was within ten days' distance of Lake Ngami. Although he knew the lake was near by he did not turn aside.

His first actual journey of discovery did not take place till 1849, when with Oswell and Murray he crossed the difficult Kalahari Desert and reached Lake Ngami itself, known only at that time by report. Although not widely recognized by the world at large, Livingstone's name soon came to the knowledge of the Society for Captain Steel, who had been associated with Livingstone during hunting expeditions, was a Fellow. Steel wrote to Sir Roderick Murchison and in this way there originated the long-standing association of the two men. Murchison at once realized the value of Livingstone's journey to Lake Ngami and the Society in turn showed its appreciation by the award of a chronometer watch to "The Reverend David Livingstone for his successful explorations in South Africa."

The missionary journeys were developing into explorations and Livingstone was now making himself expert in survey. He was searching for watered lands and the search culminated in his reaching the Upper Zambezi in 1851. At that time Livingstone had had a vision of possible waterways, both eastwards and westwards, which would allow of easy travel and commercial enterprise north of the Kalahari.

After a short visit to Cape Town so that his family could return to Britain, he himself went back to the mission station, and late in 1853 set out on the journey which was to take him from Linyanti on the Upper Zambezi to Loanda on the west coast, a difficult journey which showed that he was a very determined traveller. The return from Loanda began in 1855, but from Linyanti he travelled on eastwards down the Zambezi, discovered the Victoria Falls, and finally reached the east coast at Quilimane in the summer of 1856. This great journey across Africa from west to east made Livingstone famous, and the Society, which had already recognized his promise in 1850, now awarded him

in 1855, while the journey was still in progress, their Patron's Gold Medal. We can take pride in our early recognition of Livingstone's genius.

He came back to this country in the autumn of 1856 for the first time after seventeen years. In the interval he had become a national hero. Shortly after arrival he attended a meeting of our Society, when he was enthusiastically received, and Murchison spoke in unqualified terms of the value of his discoveries. This meeting was an event such as can only take place very occasionally, when the whole country is aroused—the return of Shackleton in 1909, of Scott's companions after his last expedition in 1912, and in our own day of the Everest party.

Livingstone felt it his duty to return to Africa as soon as possible and before leaving he was entertained by the Society at a great public dinner in the Freemasons' Tavern, with Murchison presiding. There followed the Zambezi expedition which lasted from 1858 till 1864 when Livingstone found that there was no easy navigation, as he had hoped, up the Zambezi from the east coast. He was however seeking also for livable lands and found them up the Shiré River on the nearby Highlands. Lake Nyasa was discovered in 1859.

Livingstone was again fêted and entertained on his return to this country, and during his two years at home he attended many of our meetings.

He left for Africa for the third and last time in 1866, following proposals by Murchison that he should explore the watersheds of the Nile, Congo and Zambezi. As on his first journey across Africa, Livingstone travelled alone with no companions other than native followers. Murchison was President for the fourth time and was anxious to remain in office till Livingstone should again come home. He would have retired earlier but stayed on in the hope that he might receive Livingstone on his return. This was not to be, and Murchison's last meeting as President was in November 1870. He retired the following year and died a few months later. When the news reached Livingstone of Murchison's death he was deeply touched and wrote "Alas! This is the only time in my life I ever felt inclined to use the word, and it bespeaks a sore breast. The best friend I ever had—true, warm and abiding. He loved me more than I deserved."

The affection of these two men, great in their different ways, has been frequently remarked on. Some of it has been ascribed to their having both been of Celtic origin. I think this is almost certainly the case, and it should be noted that both had had ancestors who had suffered in the '45 Rebellion. The Murchison Monument on the shores of Lochalsh not far from Skye does not commemorate Sir Roderick, but was erected by Murchison himself in memory of his forbear, Donald, who had shown his devotion to his master, Lord Seaforth, by collecting as factor the rents on the Seaforth estates and forwarding them each year while Seaforth himself was in exile. This tribute to his ancestor is an unexpected side to Murchison, generally regarded as austere and aloof. Livingstone's connection with the '45 is less certain, though it is reported that his great-grandfather fought at the battle of Culloden, and an ancestor is reputed to have shown active sympathy for James Stewart of the Glens, another factor loyal to his chief, but who paid for his loyalty with his life.

Livingstone was to stay on in Africa till the end. He preferred to remain although his doing so gave rise to much anxiety and to false rumours of being "lost." He died on 4 May 1873. There followed the romantic and almost incredible journey on which his faithful servants carried his body down to the coast, when Chuma, Susi and others earned fame by a nine months' journey of 1500 miles from Chitambo's village to Bagamoyo, opposite Zanzibar. When the body reached this country it was met at Southampton by the President and

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Left to right; the Secretary of State for the Colonies, Mr. J. M. Wordie, President of the Society, and Dr. Hubert Wilson, grandson of the explorer; extreme left, Brigadier Sir John Hunt

Central Press Photos Ltd.

David Livingstone, F.R.G.S. (1813–1873)

Council of the Society and brought to London to lie in state very fittingly at the Society's House in Savile Row, prior to burial at Westminster Abbey. Dr. Mill, the historian of the Society, has described the scene and the nation-wide feeling which was aroused. The history of the Trust Fund, from which the cost of the statue has partly been defrayed, extends over a longish period but may be briefly told. After Livingstone's death his faithful servants, before setting out to carry the body down to the coast, buried the heart at Lake Bangweulu at the place where their master had died, his name cut deeply in the solid wood of the tree marking the grave. This is the tree which may now be seen in our Museum, for in due course it was reported to be in a decaying state, and the lower portion was therefore cut out so that the famous inscription should be preserved. It was brought to this country in 1898.

The tree was replaced by the erection of a more prominent monument, a 20-foot stone obelisk set up in 1903; the balance of the moneys raised for this memorial was placed in a Trust Fund to be used for its upkeep.

In 1948 however the obelisk was taken over by the Northern Rhodesia Commission for the Preservation of Natural and Historical Monuments, who also undertook responsibility for the upkeep. As there was no immediate use for the Trust Fund after 1948 the Council of the Society decided that the capital should most properly be used for the erecton of a statue here in London. The fund provided the nucleus, but I should also mention a generous donation made by Lord Catto, who at the time was Honorary Treasurer, without whose help the scheme could not have been carried out.

The next step was the selection of a sculptor and in this we were fortunate to have the advice of Mr. William King, President of the Royal Society of British Sculptors. The choice ultimately fell on Mr. T. B. Huxley-Jones and I think you will agree that he has been most skilful in his work, has succeeded in showing Livingstone as we would like to see him, and that our present house is the most fitting site for one so warmly welcomed and encouraged by our Society for nearly twenty-five years.

Dr. HUBERT WILSON (representative of the Scottish National Memorial to Livingstone Trust, Blantyre) then said: Mr. President, Ladies and Gentlemen —As the grandson of David Livingstone I fear I am a disappointment because my mother was only a school-girl when her father died and her recollections of him were limited to when she was seven years of age and when Livingstone was last in this country. When my mother came out to Africa forty years or more after her father died we got some of the chiefs and headmen together and they told us exactly what they remembered of Livingstone in his early days. If you sat with one of Livingstone's last journals before you, you could not have caught those men out, so exact were they in everything they said.

I have always tried when in Africa to meet those who remembered my grandfather. I met one old man, one among many who remembered his coming to that part of the country although he was only a wee small boy at the time. He said: "We were children at the time and we always remembered Livingstone as the man who came out of the Lake and lived under the water because his hair was so straight and not like ours at all. Whenever we saw him doing anything we watched with all our eyes, because we had never before seen a man like him and we never knew what he would do. One day we saw him going away by himself among the reeds on the shore of the lake, so we crept up and hid in the reeds to watch what he did. He took something in his hands and we thought he was going to return into the lake or perhaps worship his ancestors. But he worked with his hands all over his head and brought his brains out on top of it. We had never seen a man who could bring his brains out." Actually

Livingstone was washing his head and the people had never before seen soap lather.

This year I met a very old man not far from Abercorn in Northern Rhodesia. When he was told that I was the son of Livingstone's youngest daughter he said: "Then he must be the grandson of the man who ate eggs." I asked what he meant by that and the man who was with me laughed and said: "You know in those days the people here never thought of using an egg as human food. When Livingstone was not well he asked the people one day to get him some eggs which he ate, and he was remembered ever after that as 'the man who ate eggs'."

When I was in Bechuanaland this year, I saw the house that Livingstone built, the only part left being the first two courses of stone, and I cannot but think that they were put there by Livingstone's own hands because he would himself have laid the foundation of his house although others might complete it. It was in a lovely spot—a spot to be remembered.

I am very appreciative of all that this learned Society did in those past days to back up and to help my grandfather. In fact, the Royal Geographical Society has been a name to conjure with in our house as long as I can remember, and it is nice to know that Livingstone's statue has a place in front of the house of a Society which has such a long tradition of usefulness behind it. Our own Memorial in Scotland at Blantyre is a Mecca to which thousands of people come each year; among them many young folk and children. It is good that they should visit the memorial because Livingstone's example is one that is well worth following.

The PRESIDENT: And now I ask the Rev. Maxwell Janes to add a few words. He is General Secretary of the London Missionary Society which sent Livingstone out to Africa in his early days.

The Rev. MAXWELL O. JANES: Mr. President, Ladies and Gentlemen—In the Board Room of the London Missionary Society in Westminster there hangs a portrait of David Livingstone in the place of honour, immediately behind the chair in which sits the Chairman of our Board; every Director of the Society on entering the room finds his eyes focused upon that portrait, for Livingstone was one of the most famous of all the missionaries of the Society.

The Directors of the London Missionary Society rejoice to-day, Mr. President, that the statue of Dr. Livingstone is being unveiled so that all who pass along the busy street can be reminded of a great explorer and discoverer, and even more a great missionary. Brought up as he was in a devout Christian home, and being of an adventurous, chivalrous and altruistic nature, it is not surprising that when he read in a letter from a Dutch missionary in China that there was a great need for medical missionaries in that land, he responded to the call. He began to prepare himself by hard work and study for the life of a medical missionary, and when he felt ready he made an offer of service to the London Missionary Society. If you look among the various exhibits in the exhibition here today you will find the letter in which he made this offer.

Towards the end of his training Livingstone heard an address by Dr. Robert Moffat, who later became his father-in-law and who was one of the Society's missionaries in Africa. Dr. Moffat described how often he had stood on a height above Kuruman in Bechuanaland and seen clearly in the north the smoke of a thousand villages where the Gospel had not been proclaimed. That vision must have impressed Livingstone, for at the end of the address he approached Dr. Moffat and enquired diffidently whether he thought he would do for Africa. Moffat's reply was: "Yes, if you are prepared to leave occupied

ground and push to the north." That sentence was prophetic of Livingstone's missionary career in Africa.

After a period of apprenticeship at Kuruman, during which he mastered the language and learned the ways of Africa with characteristic thoroughness, Livingstone began to trek north. Wherever he went he preached, and slowly built up little congregations of Christians.

As he moved northwards he sought vainly for healthy sites for new mission stations, until at last he stumbled on the Zambezi and was shocked to the depths of his soul by his discovery of the slave trade.

I think I am right in saying that all Livingstone's future exploration, exploration in which this Society took so great an interest and had so honourable a share, had, as its underlying motive, the opening up of a way into Central Africa for Christianity and commerce—twin agents, as he saw them, for the redemption of Africa from paganism and slavery.

As a missionary Livingstone was keenly aware of the overwhelming importance of the conversion of individual men and women to the Christian faith and he strove to bring men to Christ. But he was also keenly aware of the need to redeem Africa from social evils—poverty, ignorance, tribal warfare and, above all, slavery; the diffusion of better principles and the development of legitimate trade were urgent priorities, the legitimate trade to cast out the illegitimate.

Livingstone regarded the end of the geographical feat of opening the way into Africa as the beginning of the missionary enterprise; and in order to be free to pursue his discoveries he resigned from the missionary staff of the London Missionary Society and accepted Consular service in East Africa. But to the end he was a Christian missionary, preaching whenever occasion offered, even when he was ill and close to the end of his life.

As I began by saying, in the Board Room of the London Missionary Society Livingstone's portrait has the place of honour, above the Chairman's chair. That chair was made in Africa, in the workshops at our station at Mbereshi, in Northern Rhodesia. It was made by Africans who no longer fear slavery, who have been trained in craftsmanship, and in self-respect, and who draw their inspiration and comfort from the same Lord as did David Livingstone. They have been educated in the things of the mind and the body, and are responsible members of the Christian Church. Out of gratitude for what the London Missionary Society has done for them they gave that chair to the Society some little while ago. Whenever I go into the Board Room and see the portrait of Livingstone and the chair, I feel that eloquent testimony is borne to the value and importance of the redemptive work which Livingstone did. So I am grateful that our Society and yours has the opportunity today of sharing in this auspicious occasion.

The SECRETARY OF STATE FOR THE COLONIES then said: Mr. President, Ladies and Gentlemen—I am sure you have enjoyed the speeches to which you have just listened and in particular that of David Livingstone's grandson, couched in the most appropriate language and pronounced with the excellence that always calls forth the respect and veneration of those born south of the Border.

Now, sir, when we look back upon the nineteenth century with the perspective of another half-century of distance run, we see that it was an age of great men. Foremost among them we see the heroic virtues of their age epitomized in David Livingstone to whose immortal memory we meet today to do honour. It can be said that Livingstone unlocked the door of the African continent and opened a new page in its history. His remarkable journeys across Africa, undertaken on foot with only a few African attendants and in the face of unimaginable

hardship, led the countries of Europe to open up this unknown continent and at the same time laid before the world all the horrors of the slave trade. All the aspects of Livingstone's life and work combine to form one great humanitarian purpose. By penetrating the almost limitless and then unknown land of Central Africa, he brought the Word of God to the African people: he opened the way to trade and to the civilizing influence which followed it: and he exposed and attacked two scourges which overshadowed the people of Africa—the slave trade and the relentless tribal wars, with all their terrible tragedies of human suffering.

All here know well the love that Livingstone inspired in the Africans and the devotion with which his African attendants carried his body through unknown hostile country to the coast, to lie at last with his nation's other heroes in Westminster Abbey. Today, eighty years after his death, the unknown lands through which Livingstone passed in the twenty years between 1853 and 1873—Bechuanaland, Mozambique, the Belgian Congo, Northern Rhodesia, Nyasaland and Tanganyika—are each moving forward towards nationhood, in the great awakening of the African continent. We who have inherited the task of helping the African people in their forward march can only try in humility to follow the example of patience, tolerance, humanity and dedication that his life set us.

Before I unveil the statue to Livingstone's memory I can do no better than recall to your minds the words in which Lord Curzon enshrined David Livingstone's claim to lasting fame at the time of the Royal Geographical Society's celebration in 1913 of the centenary of Livingstone's birth: "As a missionary he was the sincere and zealous servant of God. As an explorer he was the indefatigable servant of science. As a denouncer of the slave trade he was the fiery servant of humanity."

Those present then proceeded to the pavement on the north side of the Society's Hall in Kensington Gore, and the Secretary of State for the Colonies unveiled the bronze statue of David Livingstone.

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Nuwarakalawiya looking south from Anuradhapura

Chena on a very steep hillside

"Mudding" paddy fields near Hambantota

Harvested paddy, Palugaswewa

PROBLEMS OF LAND USE IN THE DRY ZONE OF CEYLON

B. H. FARMER

THE DRY ZONE of Ceylon (see Fig. 1) is that rare phenomenon in Southern Asia, a relatively large area with a sparse population and with opportunities for colonization. It was specifically to study peasant colonization that I visited Ceylon in 1951, and I should like to thank those bodies and individuals who made my work possible; the Royal Geographical Society, the Royal Institute of International Affairs and the Leverhulme Trustees for finance, my College and University for leave of absence, and many Ceylonese individuals, from Prime Minister and High Commissioner to peasant, for help and hospitality.

I do not propose however to confine myself to peasant colonization today,[1] but to discuss certain broader problems of Dry Zone land use. I do not pretend that my brief survey will be more than a general reconnaissance. Apart from my own observations and from the excellent one-inch map of Ceylon, there are a few sources of statistical data[2] and a certain amount of written material.[3] But there is a great need for a comprehensive survey of land use, as was, indeed, recognized by the mission of the International Bank which recently visited Ceylon[4]; there is also a need, unfortunately less recognized, for research of a more fundamental character into groundwater conditions and into other physical factors in land use.

The Dry Zone environment

Certain physical factors are of prime importance in the study of Dry Zone land use.[5] In the first place, the Dry Zone, although superficially a plain, is diversified by rocky ridges and isolated hills and less obviously by low divides, which ensure that everywhere outside the coastal alluvium slopes are sufficient to complicate irrigation, to induce catenary series of soils, and to make soil erosion a hazard to be reckoned with.

In the second place, while the Dry Zone is in no sense arid, drought is certainly among its problems. There is always a dry season during the south-west monsoon; the north-east monsoon usually brings rains, but these are sometimes late (as in 1952–3) or feeble; and inter-monsoonal rains are

[1] See B. H. Farmer, "Colonization in the Dry Zone of Ceylon," *J. Roy. Soc. Arts*, 100 (1952) 547–64, and "Peasant Colonization in Ceylon," *Pacific Affairs*, 25 (1952) 389–98. The author is also preparing a fuller study on the subject under the auspices of the Royal Institute of International Affairs.

[2] See, for example, the *Census of Agriculture*, 1946, *Ceylon Government Gazette* No. 9764, 16 September 1947.

[3] See especially *The Tropical Agriculturist* (Peradeniya, Ceylon).

[4] See their report, "The Economic Development of Ceylon" (Colombo, Govt. Press, 1952), vol. 1, p. 77, and vol. 2, pp. 157–60; and (Baltimore, John Hopkins Press, 1953), pp. 122 and 365–9.

[5] For a further discussion of the Dry Zone environment, see E. K. Cook, 'Ceylon,' 2nd ed., revd. K. Kularatnam (Madras, etc., 1951).

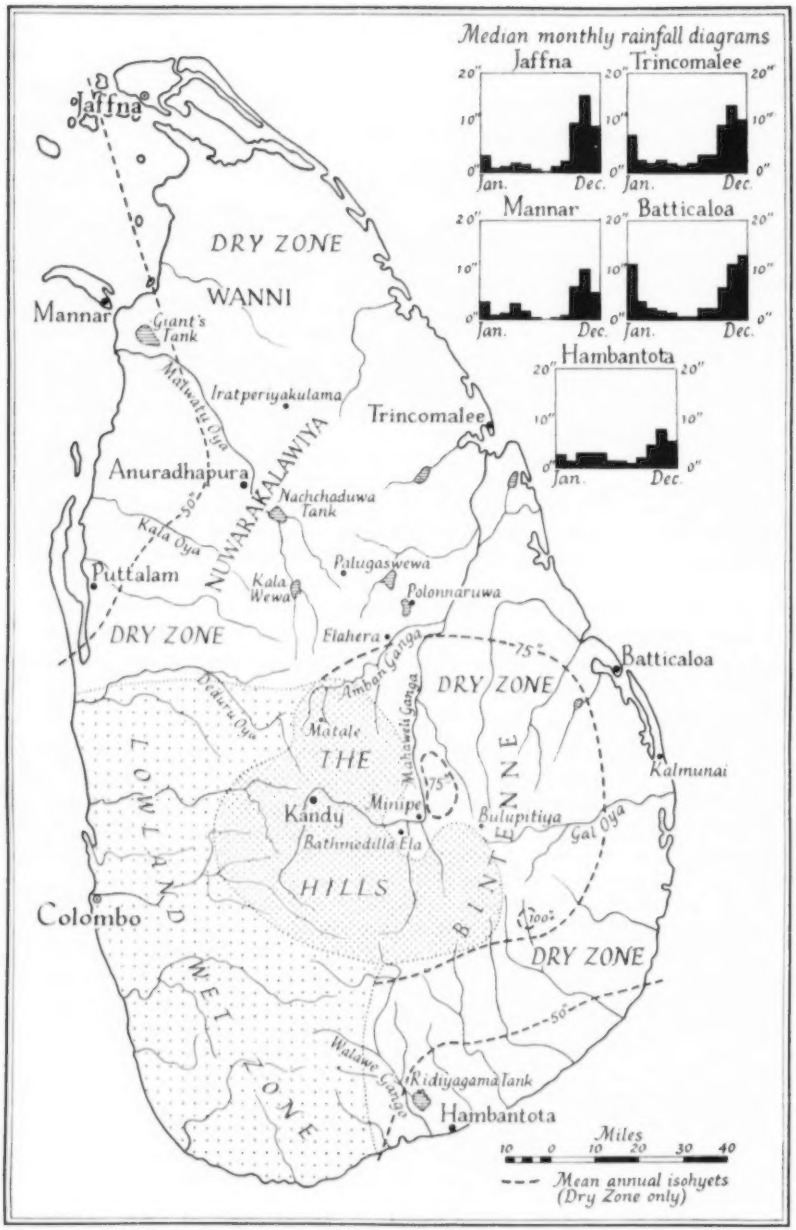

Median monthly rainfall diagrams
Jaffna
Trincomalee
Mannar
Batticaloa
Hambantota
20"
10"
0"
Jan.
Dec.
Jaffna
DRY ZONE
WANNI
Mannar
Giant's Tank
Iratperiyakulama
Trincomalee
Anuradhapura
NUWARAKALAWIYA
Nachchaduwa Tank
50"
Kala Oya
Puttalam
Kala Wewa
Palugaswewa
Polonnaruwa
DRY ZONE
Elahera
75"
Batticaloa
DRY ZONE
Amban Ganga
Mahaweli Ganga
Matale
THE
HILLS
Kandy
Minipe
Bathmeddula Ela
Bulupitiya
Gal Oya
Kalmunai
LOWLAND
WET ZONE
BINTENNE
Colombo
100"
DRY ZONE
50"
Walawe Ganga
Kiddiyagama Tank
Hambantota
Miles
10 0 10 20 30 40
Mean annual isohyets
(Dry Zone only)

Figure 1

markedly fickle. Mean rainfall figures must be treated with great caution.[1] One must bear in mind, too, that evaporation rates are high so that the rain which does fall is frequently ineffective.[2] Rainfall appears generally to be ineffective in the dry season; and the frequency with which it is effective in the inter-monsoon season varies with the station.

Many other tropical regions experience seasonal variability and ineffectiveness of rainfall; and Tamil Nad in particular is very near to being a climatic homologue of the Dry Zone. But the Dry Zone (apart from Jaffna) is handicapped in comparison with Tamil Nad by the poverty of its ground-water resources, which are virtually restricted to the variable surface layer of decayed rock, soil-forming material and soil over impermeable crystalline rocks. The total held there cannot be great, even in the wet season when the layer tends apparently to be saturated; and, away from valleys or irrigation works, the water-table appears to fall drastically in the dry season. Irrigation must therefore be mainly a matter of storing water in surface tanks, or of tapping the wet season flow of rivers by weirs or *anicuts*. But most Dry Zone rivers become mere strings of pools in the dry season, so that great perennial canals, like those of the Cauvery delta, are generally out of the question.

Dry Zone soils,[3] though less laterized than those of the Wet Zone or of say Malaya, have this in common with most tropical soils that they are relatively poor in, and soon lose, humus and nutrients. There is relatively little alluvium; and here again the Dry Zone is at a disadvantage compared with Tamil Nad. The catena concept is often applicable[4] (Fig. 2) and there is a grading downhill from a zone of leaching and eluviation on hill-tops and slopes to a valley-floor relatively rich in humus, clay and nutrients. These valley-floors are frequently water-logged in the wet season, but being by their position often irrigable, they constitute a real asset. Dry Zone soils very readily become degraded and eroded when the forest cover is removed, and suffer severely from the very heavy falls of rain which tend to occur from time to time, especially when hardened by the dry season and compacted by the first downpour of the wet season.

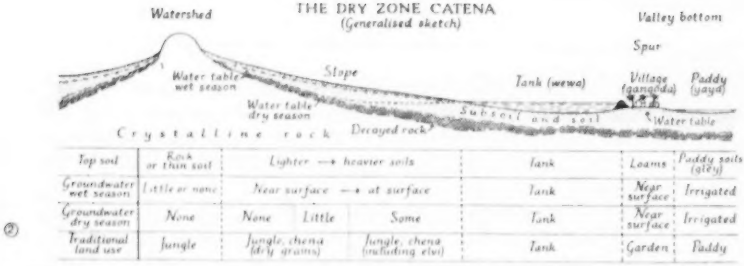
The Dry Zone of Ceylon is thus a region with much spare land, but with a combination of most of the difficulties to be found in a tropical environment. Marked relief, a seasonal, variable and often ineffective rainfall, negligible underground and relatively small surface water resources, and soil difficulties should induce caution in the development of the region, but there is sometimes excessive optimism; the Dry Zone is seen as the Promised Land in which all the country's economic problems will be solved. Optimism has been stimulated by the virtual conquest of malaria by DDT. (Malaria was undoubtedly the most potent single factor discouraging settlement in the

[1] Figure 1 shows *median* monthly rainfalls.

[2] "Effective rainfall" is here taken to mean rainfall which is adequate to preserve soil moisture above wilting point. For a fuller discussion see B. H. Farmer, "Rainfall and Water-Supply in the Dry Zone of Ceylon" in C. A. Fisher and R. W. Steel, 'Geographical essays on British tropical lands' (in the press).

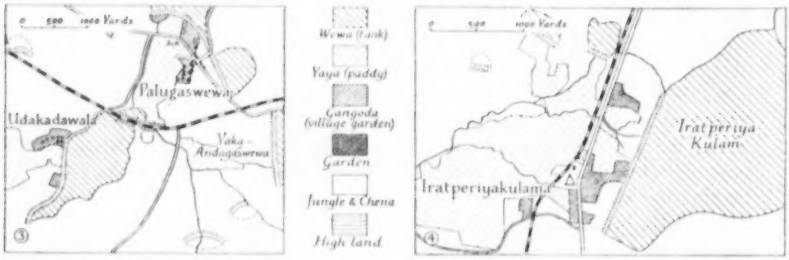
[3] See, in particular, A. W. R. Joachim, "A Review of Progress in the Study of the Soils of Ceylon," *Proc. First Ann. Sess., Ceylon Assoc. of Sci.*, pt. 3 (1945) 21–30

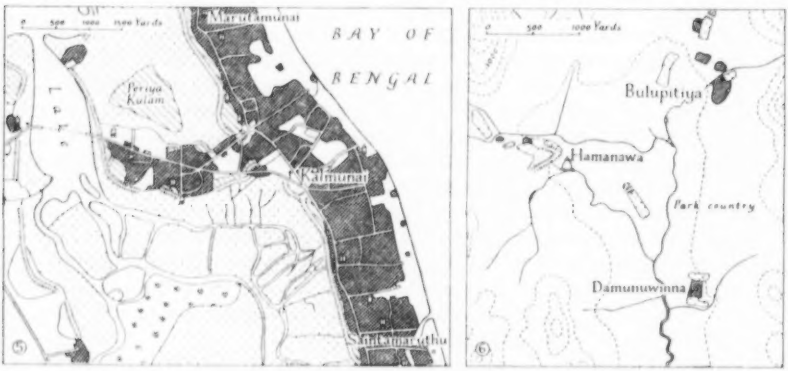
[4] See G. W. Robinson, 'Soils,' 3rd ed. (London, 1949), p. 508.

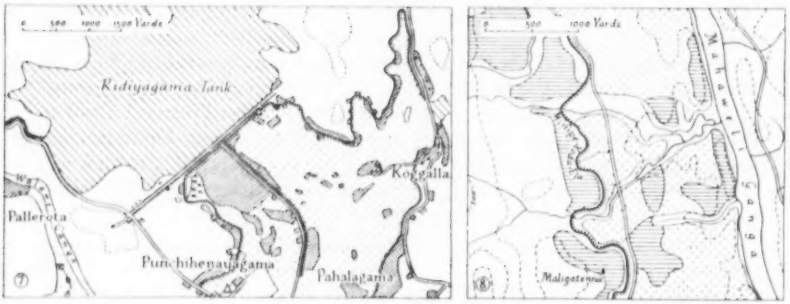


Top soil	Rock or thin soil	Lighter → heavier soils			Tank	Loams	Paddy soils (gley)
Groundwater wet season	Little or none	Near surface → at surface			Tank	Near surface	Irrigated
Groundwater dry season	None	None	Little	Some	Tank	Near surface	Irrigated
Traditional land use	Jungle	Jungle, chena (dry grains)		Jungle, chena (including elvi)	Tank	Garden	Paddy

②







Figures 2–8

3. Palugaswena village. 4. Iratperiyakulama village. 5. Kalmunai region (east coast). 6. Villages in Bintenne. 7. Part of Walawe left bank scheme. 8. Part of Minipe colony

Dry Zone until very recently, and it may have had something to do with the downfall of the ancient civilization there).

Indigenous land use

The Dry Zone economy is primarily agricultural and rural; and the Dry Zone village is often still surprisingly self-sufficient both economically and socially, offering a fascinating and little-explored field of study. There is one particular result of isolation which is of great interest, namely, the preservation of traditional land use systems, now to some extent modified under the impact of a money economy and of recent Government policies. It is proposed to discuss the suitability of these systems as a means of using the land of the Dry Zone in perpetuity, then to explore possible future uses of land, particularly of "high," that is, unirrigable land. It will be convenient to discuss in some detail traditional land use in Nuwarakalawiya, which may be regarded as a norm, and then to outline one or two local departures from this norm.

Agriculture in Nuwarakalawiya, the metropolitan area of ancient Ceylon, is characterized by a threefold system of land use: the peasant normally has paddy-fields, a garden around his house, and a *chena*, or patch under shifting cultivation in the jungle (Figs. 3, 4). This threefold system has much in common with systems elsewhere in South Asia, though rarely do sedentary cultivators practise shifting cultivation on high land after the manner of the Dry Zone peasantry.

The *yaya*, or stretch of paddy fields, is normally situated beneath a village tank or, more rarely, some other type of irrigation work. There is a high standard of indigenous irrigation technique, but the geographer interested in the maximum utilization of resources, cannot but notice the waste of water, quite apart from loss due to evaporation. The peasant tends to wait till his tank is full before starting *maha* (north-east monsoon) cultivation, thus losing the value of early, direct rainfall which is often sufficient to permit cultivation. (His practice results however from the joyless experience of starting to cultivate only to find that the rains have not filled his tank sufficiently to permit him to continue.) Moreover, too much water is used when a crop is actually being irrigated. On the other hand, there is a traditional method, known as *bethma*, for conserving water during the *yala* (or south-west monsoon cultivation). It often happens that there is in this dry season only sufficient water to cultivate part of a given *yaya*. It would then be most wasteful if each peasant cultivated part of his own holding, since the whole of the field channels would be in use and loss of water from them by evaporation and seepage at a maximum. The custom is therefore to concentrate on the part of the *yaya* nearest the tank, which is then divided between all the cultivators in proportion to their several holdings in the *yaya* as a whole.

Very much could be done to improve standards of cultivation, and much is in fact being done. Traditionally, the peasant uses poor seed; cultivates with simple wooden implements or by "mudding" (*i.e.* merely by driving buffaloes around the flooded fields) and has no real system of manuring or rotations; and poor technique is one factor, but not the only one, responsible for low yields. Yet it cannot reasonably be doubted that paddy is the best basic crop

for all irrigable areas. For the very system of bunding which keeps the water in the fields at the same time helps to conserve the soil, which is in any case built up by paddy cultivation; and paddy cultivation does enable a crop to be grown for all time on tropical land.[1] It is not surprising that it is the ownership of paddy land which carries social prestige.

The second element in the threefold system, the *gangoda*, need not long detain us. *Gangoda* means "village place," and in fact the first thing which strikes one is the closely packed houses in tiny fenced compounds, with their neat *bissas*, or baskets on stilts for storing paddy. But around the houses there lies a kind of wild garden, planted or self-sown with a variety of fruits, vegetables and other useful plants which *inter alia* provide materials to be curried and eaten with rice. In this garden-land, the coconut (*Cocos nucifera*) is dominant and there are usually specimens of jackfruit (*Artocarpus integra*), arecanut (*Areca catechu*), mango (*Mangifera indica*), papaya (*Carica papaya*), and plantain (*Musa* spp.) together with other plants.

This wild garden by its very approximation to jungle, is well suited to protect the soil from the evil effects of sun and rain. (It has, of course, been maintained that tree cultivation is the ideal method of permanent cultivation of high land in the Tropics.[2]) But it must be stressed that the *gangoda* is a very special type of high land, in whose subsoil the water-table is usually preserved by proximity to a tank or other irrigation work. Only a few *gangoda* trees, such as the mango, are naturally adapted to the Dry Zone. Other trees are able to grow only because of the artificial soil moisture conditions, and they may find themselves in difficulties in time of drought, when tanks dry up.[3] The *gangoda* is, in fact, virtually a piece of the Wet Zone in a Dry Zone setting, and, as will be seen, this fact has not been sufficiently borne in mind in attempting to plant tree gardens in high lands with different hydrological conditions.

Around the *gangoda* and *yaya* of the Nuwarakalawiya village there stretches the jungle. As in medieval England, this waste land is used as pasture for cattle, as a source of timber and wild vegetable products, and for hunting. But it is also the site of the village *chenas*, the third element in the land use system, which will be discussed in some detail: for they raise controversial issues, introduce the whole question of the use of high land in modern, as distinct from indigenous Dry Zone agriculture, and prompt conclusions which may be applied to the Tropics generally.

The *chena* system, apart from the fact that it is practised by a peasantry which also cultivates fields in perpetuity, has much in common with shifting cultivation in other areas. The peasant chooses his patch, preferably in relatively high jungle because of its better soil, and clears and burns it during the dry season. During the first north-east monsoon rains light scraping with a hoe is followed by the broadcast sowing of such crops as maize, kurakkan

[1] For the suitability of rice in tropical land use, see Pierre Gourou, trans. E. D. Laborde, 'The tropical world' (London, 1953), p. 100; also R. L. Pendleton 'Agricultural Potentialities of the Tropics,' *Agronomy Journal*, Vol. 42 (1950), pp. 115–123, especially p. 120.

[2] See, for example, Pendleton, *op. cit.*, p. 122.

[3] As in December 1952, owing to late *Maha* rains.

(*Eleusine coracana*) and sorghum (*Andropogon sorghum*). Crops such as manico (*Manihot utilissima*), sweet potatoes (*Ipomoea batatas*) and plantains are also grown, with *elvi* (hill or dry paddy) in water-logged situations. A catch crop of some such plant as gingelly (*Sesamum indicum*, sesame) may be grown later, during the fickle March–April inter-monsoon rains, but this is clearly apt to be a risky procedure. Indeed, *maha chenas* may also fail through drought, as happened in some areas in 1951–2. *Chenas* are abandoned, usually after one or two years, when weeds, rather than decreased fertility, defeat the cultivator.[1] Abandoned *chenas* in Nuwarakaliwiya normally witness a plant succession from weeds through scrub and secondary jungle to something approaching high jungle. In other Dry Zone regions, as will be seen, regeneration is for various reasons less perfect.

It has been usual in Ceylon to condemn the *chena* system as primitive and pernicious. But the fact remains that, in Nuwarakaliwiya at any rate, it has enabled the use of high land to continue for very many centuries without impairing the soil; for it is undoubtedly ancient. The work of Joachim and Kandiah has shown that, with the length of rotation common in Nuwarakalawiya, *chena* cultivation depends almost entirely on the nitrogen and minerals made available by the burning of the jungle, and, provided the *chena* is abandoned after two or three years, reservoirs of nutrients in the soil are largely untapped; they are in any case restored after five to ten years of recuperation.[2] The proliferation of tropical weeds is here a blessing in disguise, since it not only forces abandonment before damage is done to the composition and structure of the soil, but also serves to check erosion. It is true that one can watch erosion at work in a *chena*, especially when the first heavy *maha* rains compact an already hard-baked soil; but on fairly gentle slopes stumps and weeds impede the travel of material, which in any case is finally arrested by the ambient jungle. The *chena* system is, in fact, like shifting cultivation in much of Africa, "less a device of barbarism than a concession to the character of a soil which needs long periods for rest and regeneration."[3] And, as will appear later in this paper, it is by no means clear that a safe alternative method has yet been found.

On the other hand, it is very clear that *chena* is dangerous in the extreme on steep slopes or on very light, readily erodible soils. And, as elsewhere, the system becomes truly pernicious if the population increases beyond a critical density. It is clear in the field that this stage has been reached in such areas as that immediately to the west of Kala Wewa, and that it will soon be reached elsewhere. It is not easy to say what the critical density is. In the Kala Wewa area, the present density may be approximately critical at about 200–250 per square mile; field research into this problem would yield valuable results.

In general then it may be said that, whatever criticisms may be levelled at the technology of the peasant of Nuwarakalawiya and Wanni, his threefold system of land use is based on sound ecological principles, at least in relation to a low level of population and a primarily subsistence economy.

[1] See A. W. R. Joachim and S. Kandiah, 'The Effect of Shifting (Chena) Cultivation and Subsequent Regeneration of Vegetation on Soil Composition and Structure,' *Tropical Agriculturist*, Vol 104 (1948), pp. 3–11.

[2] See Joachim and Kandiah, *op. cit.*

[3] See Lord Hailey, 'An African Survey' (London, 1938), p. 1.

Turning to variants of the threefold system in the Tamil areas of the east coast the bulk of the population lives on the long, sandy coastal bar in large crowded settlements, in houses surrounded by the familiar gardens in which the coconut is markedly dominant (Fig. 5). There is here no major land use problem although coconuts have to struggle against drought. The paddy-lands cultivated by the local peasantry are distinctive; they are to be found for the most part not near the villages, but across the lagoons and creeks which separate the coastal sand-bar from the mainland. Here, on wide stretches of alluvium, are some of the largest tracts of paddy in Ceylon, owned for the most part by Muslim landlords. Wide alluvial tracts of paddy are also to be found to a lesser extent in other regions of the Dry Zone, especially in the Giant's Tank region near Mannar.

In much of the region known as Bintenne [1] (see Fig. 1), there are few tanks, and hence little paddy and few *gangodas* (Fig. 6). Here, especially away from the main roads, there exists a sparse population which lives almost entirely by *chena* cultivation, and is poverty-stricken in the extreme. A further distinctive feature of this region is the general tendency for abandoned *chenas* to be invaded by that scourge of the tropics, the grass *Imperata cylindrica*, known to the Sinhalese as *illuk*. This grass, for some reason which needs investigation, even after the careful work of Holmes, is encountered in force in relatively few areas west of the Mahaweli Ganga.[2] Possibly its preference for Bintenne is connected with soil impoverishment due to too rapid a *chena* cycle; but it has invaded certain high lands of Bathmedilla Ela colony, which were cleared from high jungle and *never* cultivated. Possibly its distribution may be correlated with the outcrop of the Bintenne gneiss; this is rich in quartz and often weathers to a sandy loam which appears to be only too erodible; it may be that *chenas* in such soil lose fertility and soil itself more rapidly than elsewhere, so that forest cannot establish itself immediately on abandonment. Once *illuk* is dominant, it tends to remain so, as elsewhere in the Tropics, owing to accidental or deliberate burning; and poor, savannah-like grassland (*damana*) has established itself as a fire-climax over much of the region, with further soil degradation as a result. Here *chena* appears to be truly pernicious.

Modern changes in peasant land use

During the last hundred years or so, the lowland Dry Zone has been exposed to such external influences as the land policies of a colonial government, and a money economy geared to world conditions. In the Dry Zone village these forces have not meant fundamental changes in land use; there has been a tendency to sell a greater proportion of the crop and, especially in new, linear villages along main roads, to concentrate on crops with a cash value. But on the whole the new activities have been carried on within the well-established framework of the threefold system of land use. Again, in

[1] Not to be confused with the two administrative units of the same name, one in Batticaloa District and one in Badulla District; "Bintenne" is used here as a *non de pays*.

[2] See C. H. Holmes, "The Grass, Fern and Savannah Lands of Ceylon," *Imp. Forestry Inst. Paper* No. 28 (1951). For a general treatment, see "*Imperata cylindrica*," *Imp. Agric. Bureau. Jt. Pub.* No. 7 (Oxford and Aberystwyth, 1944).

Bissas in a Nuwarakaliwiya village

A highland allotment on too steep a slope, Bathmedilla Ela Colony

Damana (savannah) near Polonnaruwa

Palmyras (Borassus flabellifer) in sand, Jaffra peninsular

land settled by individual initiative under Government irrigation works before aided colonization began in 1932, the familiarly threefold pattern emerges (Fig. 7). Paddy land tends, in these wide, irrigated tracts, to be more dominant than in the old villages, but there are many stretches of garden where the preservation of a high water-table means an approximation to *gangoda* conditions; and *chena* is often practised on surrounding high land.

In the new colonization schemes the basic element in each colonist's allotment is a holding of paddy. These paddy holdings raise many interesting problems, but, as in the older major schemes, no new land use principle is involved. (Fig. 8).[1] But a new principle *is* involved in the allotment of high land for permanent cultivation. The most successful high land allotments are those whose position approximates to that of a *gangoda*, so that there is no fundamental difficulty in growing coconuts and other trees. Frequently however high land allotments are situated on slopes considerably above surface water, and above the dry season water-table. Here colonists run into many difficulties. Domestic water-supply becomes a real problem, and well irrigation is out of the question. Even on the gentler slopes, erosion can be seen at work, and is apt to be more dangerous than in *chena* because large, continuous tracts are cleared and stumped, and kept clean. With no indigenous system of soil conservation on high land, it is not easy to enforce adequate measures. There is likewise no tradition of crop rotation or mixed farming to ensure the maintenance of soil fertility.

Permanent tree cultivation, at least of valuable species, is also difficult on such high land, which tends to be treated as if it were a *gangoda*, or even a piece of Wet Zone high land. Colonists have been issued with coconuts, jackfruit and other moisture-loving trees, which have often perished. More work appears to be needed on trees suited to local conditions; and, in the highest and driest of lands, it may be necessary to fall back entirely on trees adapted to drought, such as the mango and the palmyra (*Borassus flabellifer*).

Similar problems are encountered where permanent peasant cultivation of high land is attempted *outside* the colonization schemes. Frequently to-day grants of land are made under the fundamentally sound provisions of the Land Development Ordinance.[2] If these grants are of paddy land or of land experiencing *gangoda* conditions, there is no real difficulty. But where they are of true high land, the peasant tends to treat his plot as though it were *gangoda*, or as if it were *chena*, but cultivated permanently with no rest period. It will be clear, after what has been said, that either method is fundamentally unsound.

The future

It will be evident that the crux of the matter in the Dry Zone is the use that can be made of true high land, land which can be neither *yaya* nor *gangoda*.

[1] See B. H. Farmer, "Colonization of the Dry Zone of Ceylon," *J. Roy. Soc. Arts*, 100 (1952) 547–64, and "Peasant Colonization in Ceylon," *Pacific Affairs*, 25 (1952) 389–98.

[2] See *Land Development Ordinance*, No. 19 of 1935 (Ceylon), which has provisions to prevent alienation and fragmentation and to enforce (in theory) conservation and sound husbandry.

The replacement of *chena* in areas of critical population density, the cultivation of high land allotments in colonization schemes and in expanded villages, and possibilities for commercial agriculture are all facets of this problem. Some may object that the Madras Tamil seems to cultivate permanently on high land. But over wide areas he has sedimentary rocks which are aquifers, and he can practise well irrigation; the lighter rainfall presumably makes for a lower rate of erosion; stretches of *regur* soil, probably in part a response to lower rainfall, are retentive of moisture; and in any case, to judge by the prevalence of poor scrub, many high land areas are grossly over-used. A thorough study of land use in Tamil Nad would assuredly however reveal some points of interest to Ceylon and to other tropical areas of seasonal rainfall.

A solution to the problems of Dry Zone high land use has become the more urgent because there are only limited opportunities for future extension of the traditional paddy and *gangoda* systems, yet the pressure of population is very great. It is not surprising that for some time the Ceylon Government has been experimenting with methods for the permanent cultivation of high land of which relatively there are still abundant reserves. As long ago as 1907, Dr. J. C. Willis issued a circular suggesting methods by which continuous cultivation could be achieved,[1] and the present research station at Maha Illuppallama in fact dates from the same time. Recently, work has been going on not only at research stations but also in two "dry farming" colonization schemes whose object is to determine the conditions under which peasants can make a living entirely from high land cultivation without imperilling the soil.[2] ("Dry farming" here has its Ceylon connotation of unirrigated cultivation of Dry Zone high land; clearly this has little in common with "dry farming" in the American sense.)

Results so far are reasonably encouraging; though there is rather too much optimism. The need to maintain the water-table in high land is now realized in some quarters at any rate, and it is proposed to build small *bunds* across minor valleys in order to make tiny tanks. If the water-table can in fact be thus maintained, and if there is room for home-steads beneath these tanks, then *gangoda* conditions will have been created. But the multiplication of small tanks will mean the multiplication of areas likely to be water-logged, and needing a special form of land use (*e.g.* rain-fed paddy, or *elvi*).

Contour ridges and similar devices employed in water conservation are also, of course, useful in soil conservation. But a great need in dry farming in Ceylon is the discovery of a cover crop which will survive the dry season, at the same time improving soil content and structure, reducing soil temperature and hence loss of organic matter, and protecting the soil from the first heavy rains of the wet season. Various legumes have been tried with varying success, one of the most promising being *dhall* (*Cajanus cajan*).

Results so far suggest that methods of rotation and fallowing, combined

[1] See J. C. Willis, "Rotation of crops upon *chena* land," *J. R. Bot. Gardens, Ceylon*, 4 (1907) 39–40.

[2] See G. Harbord, "Rotational Farming Scheme, Kurundankulama," *Tropical Agriculturist*, 97 (1941) 28–34; and P. T. Jinendradasa, paper with same title, *ibid.* 104 (1948) 27–37.

with animal husbandry, *can* maintain fertility but one is by no means convinced that a safe, permanent answer has been arrived at;[1] certainly, an answer which holds in Nuwarakalawiya is not necessarily applicable everywhere.

And even if a technique can be evolved on a Government research station, or in a colonization scheme under close supervision, it by no means follows that it can readily be taught to the great mass of the peasantry. For clearly there is a great gulf fixed between a world of contour *bunds*, cover-crops and scientific mixed farming and a world of *yaya*, *gangoda* and *chena*. Yet, equally clearly, new techniques will have to be taught, and taught quickly, to save high land allotments in villages and colonies, and to replace the *chena* system itself.

But there is a fundamental dilemma in the Dry Zone. On the one hand, to quote the World Bank Mission: "Gradual growth of dry farming is advised, rather than sudden expansion. In this way experience gained from year to year will prevent large-scale losses." [2] On the other hand, there is the insistent pressure of a population growing at some 2–3 per cent. per annum, and liable to political instability if economic conditions deteriorate. This then is the dilemma of Ceylon; the familiar dilemma of a country with a traditional system of land use better suited to local physical conditions than anything yet devised to replace it, but which is inadequate in a changed demographic context. Care is excusable, haste is excusable; and the only solution seems to be to speed up carefulness by speeding up research. Research is needed, as this paper has tried to show, not only into practical issues of husbandry, but also into fundamental conditions of climate, water-supply and soil, and into the factors behind traditional land use with all its ancient wisdom. Even the simple, threefold classification of land into *yaya*, *gangoda* and high land is not universally understood in Ceylon; still less is the need for scientific classification of even the separate parts of the same slope so that it may be used in different ways. Yet in the Dry Zone, as no doubt in many similar regions, the principle of evolving safe customs for each type of country would appear to be at the root of future development.

DISCUSSION

Afternoon Meeting, 26 January 1953

Before the paper the PRESIDENT (Mr. J. M Wordie) said: During the war, our lecturer, Mr. B. H. Farmer, had the good fortune to be stationed in Ceylon for about twelve months and, like many others, he became attracted by that country, its charm and tradition. He made plans to return and with the help and cooperation of the Ceylonese Government he was able to carry these plans into effect in 1952.

Mr. Farmer then read his paper

Mr. A. T. GROVE: We have heard a lot in recent years of the possibility of developing the desert lands, the very dry areas of the world; we have heard

[1] See Jinendradasa, *op. cit.*

[2] See their report, 'The Economic Development of Ceylon' (Colombo, 1952), Vol. 2, p. 153 and (Baltimore, 1953), p. 359. Since this paper was read, there has been published the *Report of the Committee on the Utilization of Crown Lands* (Colombo, 1953), which also discusses dry farming.

something of the difficulties involved in agricultural development in areas where the rainfall is fairly high. In Ceylon there is quite a lot of land which is not very productive, it is true, but in Africa, particularly West Africa and other tropical countries, there are millions of acres whose potentialities can hardly be guessed at but the development of these areas will be very difficult; the marshy areas may be less used in future than at present. There have been certain responses to the climate in the past which are tending to die out and one wonders whether mechanization and so on can outweigh the disadvantages of these lands.

It seems from the maps that the paddy lands are partly under water, irrigated from the tanks. That principle might be applied to the high land but part of the high land may have to be used in an unproductive way in order that the remainder of the land may yield food.

Mr. FARMER: I am grateful to Mr. Grove for pointing out how similar conditions in Ceylon are to conditions in West Africa. One of the things which tropical regions can do for each other is to exchange ideas. Ceylon is an island, and there is a certain insularity in an island; in particular there is insufficient appreciation of what is being done in South India. And there is a good deal to be said for interchange of ideas between Ceylon and other tropical areas such as those of Africa.

Mr. Grove's other points concerned mechanization, and the fact that as much land may be under water as under paddy. Not very much is known about mechanization. Attempts are being made at Government Research Stations to investigate the possibilities, but there is unceasing wear of the machines due to the nature of the soil, especially where there is a high sand content. In one place which I saw, the plough-share only lasted for an acre. In the dry season the land gets baked so hard that it is impossible to plough it, and when it is wet there is danger of erosion. Mechanization is moreover to be approached with diffidence because one has to try to reduce oxidation and decomposition of organic matter during the dry season, and if there is too much aeration those processes may be speeded up and the last state be worse than the first.

Towards the end of my talk I spoke about the idea of damming up all small valleys in the high lands which means that land may have to be wasted in order to use it. Water conservation is at the root of the problem of using the high lands.

Dr. E. R. LEACH: As an anthropologist the feature of the address which attracted me was something which Mr. Farmer was not emphasizing but which was on the sidelines of his talk all the time; that the problems of the Ceylon agriculturists are not merely technical problems but social problems. There are the problems of the organization of the village, the ownership of land and of changes in demographic and social relations which implied. If a technically correct solution is found at the agricultural research station there is still, as Mr. Farmer put it, a great gulf between the research station and the village and from a sociological point of view it is not a gulf of technique but incentive. How can the villager be persuaded of the worth of what the technician thinks is good for him?

Social research is needed to discover just what the Sinhalese peasant's attitude is to his land, the details of ownership and practice as opposed to law, and how the whole concept of property and possessions appear to the peasant as opposed to the Government official who lays down the law of right or wrong.

Mr. FARMER: I agree with Dr. Leach. The main reasons why I left social problems on the sideline was that I am not competent to talk about them, and that there was plenty to talk about in land use. All the time I was working in the field in Ceylon these social factors impinged upon me. Thus, one of the problems in the colonization schemes is to get the men to work together. In the

villages the ideal system of sharing the land in the dry season works perfectly but if one tries to put it into practice in a colonization scheme it will not work. Any system of new land use clearly has its social repercussions; one has to build a new kind of society. Again, the Government is trying to run a cooperative scheme in the villages. The study of the social implications of all these things is as desirable as research into land use *per se*.

Mr. L. S. B. SIMEON: May I make one small remark on the question of conserving water during the rainy season for the high lands? To keep up the water-table in the high lands could not the hundreds of old tanks and old tank bottoms be repaired so that they would hold the water which runs off to waste?

Mr. FARMER: Almost certainly "Yes." It is incredible how often when one clears the jungle and tries to make a channel, or to prepare a bund, one finds one there all ready. If one looks at the quarter-inch map of Ceylon one is impressed by the vast mileage of channels and number of tanks, but it is dangerous to presume that they all worked together at some time in the past and that there would be enough water to keep them all going were they all restored.

Mr. P. G. MOTT: Eighteen months ago I had the privilege of visiting Ceylon under the auspices of the Colombo Plan for the purpose of advising the Government on the employment of air photography and photogrammetric techniques. During the course of my duties there I had the opportunity of travelling over the length and breadth of this very beautiful island, which I saw both on the ground and from the air.

There can be little doubt that without the assistance of aerial methods the future development of Ceylon is going to take a very long time indeed owing to the fact that two-thirds of the country is covered by dense forest which acts as a major obstacle to any form of travel away from the main lines of communication. As an example the large-scale engineering surveys essential to the planning of all new irrigation and land settlement schemes have in the past been carried out entirely on the ground by driving lines through the jungle at regular intervals of a quarter of a mile. Some idea of the enormous labour and cost involved may be gauged by the fact that on an average it takes a labourer a whole day to clear 100 yards of line.

When it is considered that the population of Ceylon is expected to double itself within the next twenty years, it is obvious that the agricultural development of large areas of the dry zone within the next two decades is a problem of such urgency that it can only be tackled by new and more progressive means.

Following my visit the Government of Ceylon made arrangements for vertical air photography to be carried out over a number of "sample" areas, including the project involving the restoration of the old Padawiya Tank in the north of the dry-zone area. The whole of this area has now been mapped by photogrammetric methods at a scale and contour interval suited to the requirements of the development engineers. The same air photographs have also been used for specialist interpretation of the ecological and geological features, and have demonstrated that a great amount of information can be obtained from the photographs, even when the ground is covered by a dense canopy of forest. It is interesting to note how clearly the outlines of old tanks, many of them overgrown with jungle and for centuries unused, show up on the photographs.

Unless Ceylon can make use of all the technical aids of modern science for the rapid development of her resources, her sociological problems will be forgotten in the stark necessity of keeping her people alive.

The PRESIDENT: May I thank Mr. Farmer for the very interesting way in which he has put this problem before us this afternoon.

RIDGE AND FURROW IN BUCKINGHAMSHIRE[1]

W. R. MEAD

The origin of an idea

THE ORIGIN OF ridge and furrow has led in recent years to lively thrust and parry among economic historians. The geographer is not fitted to make pronouncements on ridge and furrow origins; but he may well add to their understanding by distributional studies. The surveys outlined here suggested themselves in 1948 when a lecture by W. G. Hoskins, then of University College, Leicester, hinted that there were no distributional studies more extensive than those of certain Warwickshire parishes by M. W. Beresford. The same lecture served to remind me that ridge and furrow, called "switch-back" land in my childhood, provided one of my earliest recollections of Buckinghamshire grasslands. The Bucks countryside, varied both in geology and relief, provided a good physical background for the investigation. In addition, there was the personal attraction of recording an unrecorded feature in my home county.

A description of the surveys must be prefaced by several brief comments upon the literature of the ridge and furrow controversy. First, there is the contention of M. W. Beresford that, until proved to the contrary, ridge and furrow should be regarded as the remains of pre-enclosure strips. His argument is put forward in "Ridge and Furrow and the Open Fields" (*Economic History Review*, i, I, 1948). In a subsequent paper, "Maps and the Mediaeval Landscape" (*Antiquity*, XCV, 1950), he wrote, "The single strip of the mediaeval fields is represented exactly by the ridge and furrow of the modern landscape. From one green furrow up and over the curved ridge and down the next furrow; this 22 feet or so is the *selion*, the *land*, the *ridge* of all open field documents from the twelfth century to the nineteenth." Opponents of Beresford's school of thought claim that much ridge and furrow is clearly not pre-enclosure strip but belongs to the post-enclosure period and is the result of purposeful ploughing for drainage. E. Kerridge ("Ridge and Furrow and Agrarian History," *Economic History Review*, iv, I, 1951) draws on the generous evidence of field husbandry books to support this point of view. Supplementary to his evidence are the early nineteenth century farm leases, like those of Brickhouse Farm, Rowley Regis, Staffordshire, which required "each field when in fallow to be gathered into lands of five yards width to

[1] In the preparation of this paper, I am indebted to the following schools for their kind cooperation: Amersham Grammar School, Aylesbury Grammar School, Buckingham Grammar School, Buckingham Senior School, The Cedars School of Leighton Buzzard, High Wycombe Grammar School, St. Mary's School, Gerrard's Cross and Wolverton Grammar School. Mr. A. H. Prince, County Planning Officer for Bucks, kindly permitted the use of his department's air photographs. Miss C. Baker, of Bucks County Museum, and Mr. E. J. Davies, Bucks County Archivist, have readily made available their documentary material. To Mr. J. H. Taylor and Mr. W. Mackie of the Department of Geography, University College, London, I am indebted for much painstaking and diligent cartographic labour.

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Fig. 1. Ridge and furrow as seen on an air photograph from mid-Bucks

facilitate the drainage" (M. J. Wise, "The Decay of Agriculture in a growing English Industrial Region: A Case Study," *Agricultural History*, July 1953). Such purposeful ploughing was calculated to ensure a good crop on the ridge in a wet year or in the furrow in a dry year. Thirdly, there is some ridge and furrow in Buckinghamshire which appears to be linked with the management of water meadows (*e.g.* Thame valley). Fourthly, it is not inconceivable that ridging, though born of drainage, became a rural practice in its own right—in other words, the transformation of the functional into the fashionable. Finally, there are the more entertaining theories which are discounted here, but not altogether dismissed by farmers, *e.g.* the surface area theory (ridging and furrowing can in fact add 1–1½ acres to a 150-acre farm).

The survey of a county

In the preliminary stages it was intended to make this half of the study an exercise in which eight of the county schools took two-thirds of the 130 × 6-inch sheets and engaged in a field-by-field survey. Where ridge and furrow appeared, the recording students noted both its direction and the average width from furrow to furrow. A reconnaissance revealed that the activity could not appeal equally to recorders in all parts of the county. Thus, the undertaking was tediously unrewarding in South Bucks: while, in North Bucks, it was tantalizingly demanding. Ridge and furrow is no simple feature to register. It has a wide range of wave-length and height. The difference between the narrowest and broadest wave-length in Bucks was found to be 14 yards. Heights vary from a yard (between trough and crest) to scarcely discernible inches revealed in the shadow of the setting sun. Sometimes, all that remains are faint "zebra" stripes bleached into the soil of a flattened plough land. Furthermore, even if readily recognizable, ridge and furrow has a regular form only in a minority of fields. Width and direction of furrowing may well change several times within the boundaries of a single field. It was too much to expect an accurate record of all these details from school children. Nevertheless, they produced straightforward data of width and direction of ridge and furrow for over 1850 fields in which the feature appears, as well as recording its absence in several thousands of other fields. If their reliability was not a hundred per cent., the tenacity of these assistants was commendable. One enterprising school combined field activity with an A.T.C. exercise and checked its observations from an aircraft after plotting them on the ground. The initial material was however not of sufficiently uniform quality to be the base for a reliable map.

Recourse was therefore made to air photographs. The war-time range of R.A.F. sorties (scale 1 : 10,000) provides virtually complete coverage for Bucks and is conveniently catalogued at the office of the Ministry of Housing and Local Government at Aylesbury. Figure 1 is a sample photograph showing an area of relatively strong characterization of ridge and furrow. Air mosaics (scale 1 : 6,000) cover about a third of the county and offer both complementary and supplementary material. Lack of sharpness in their photographic finish however makes them qualitatively inferior for this type of work. Air photographs of course reveal extensive areas of ridge and furrow which are no longer detectable on the ground; so that their employment changed the

original character of the investigation. The map, originally intended as a record of a landscape feature, became with its added relic evidence a statement of visually detectable ridge and furrow in the county. The inset on Figure 2 is drawn from a close personal scrutiny of the fields in the Wing/Aston Abbots area. It distinguishes between ridge and furrow recognizable on the ground (light ruling) and that additionally decipherable in air photographs (heavy ruling).

The map of Buckinghamshire ridge and furrow therefore represents a marriage of field survey and of air photographic interpretation. A combination of the two has been useful. The one has been valuable in remedying deficiencies in photography; the other, for adjusting discrepancies in recording. Almost all ridge and furrow marked on the school survey is evident on air photographs. Where it does not appear on the photographic prints, it has been omitted as inaccurate student recording. Sometimes, there are defects in the air photographs attributable to cloud, haze, light deficiency, etc. (*e.g.* Lavendon and Hanslope). Photographic coverage shows occasional gaps of thin wedge-shape between the sorties (*e.g.* Chetwode) and where these occur, they have been filled by recording on the ground.

The third stage in the preparation of the maps was reduction. The field work on 6-inch sheets, having been reduced to 2½-inch scale, was photographed down to the ½-inch scale. This scale enabled juxtaposition with the geological and relief maps of the county; but the manifold inaccuracies of detail resulting from the several processes of reduction caution against facile correlation with other surface features.

The final map (Fig. 2) confirms the statement of St. John Priest ('General View of the County,' 1813) and the generally prevailing opinion that ridge and furrow is associated with the claylands and is absent from the chalk. It can claim, however, to express this fact cartographically for the first time. A frontier zone, separating Bucks into northern and southern halves, runs from south-west to north-east across the waist of the county. It follows the line of the Chiltern scarp and extends over a distance of one to two miles on the Vale side.

South Bucks contains isolated relics of ridge and furrow. In very rare instances they can be detected on the Chalk outcrop itself. For example, there is a well-defined example on the Middle Chalk beyond the clay-with-flints on Steps Hill above Ivinghoe. It has now reverted to rough grazing. Usually however it is more common for relics to be invisible save to the sensitive plate of the camera—as on Aston Hill. There is a curious absence of association with cultivated clay-with-flints. It is conceivable that ridge and furrow extended to the Chalklands in former times; but that continuity of cultivation over a long period, with cross-ploughing, has eliminated the feature. Another fact worth recalling is that ploughing depths differ on the Chalk and in the Vale. Certain of the Chiltern valleys still bear virtual testimony to ridge and furrow—for example, Little Missenden in the Misbourne valley where the feature is developed against a background of valley gravels. In the Princes Risborough embayment, there is ridge and furrow at the 400-foot contour on the Chalk flank. Elsewhere, there are several questionable patches (*e.g.* Hughenden) which, on the map, have been given the benefit of the doubt.

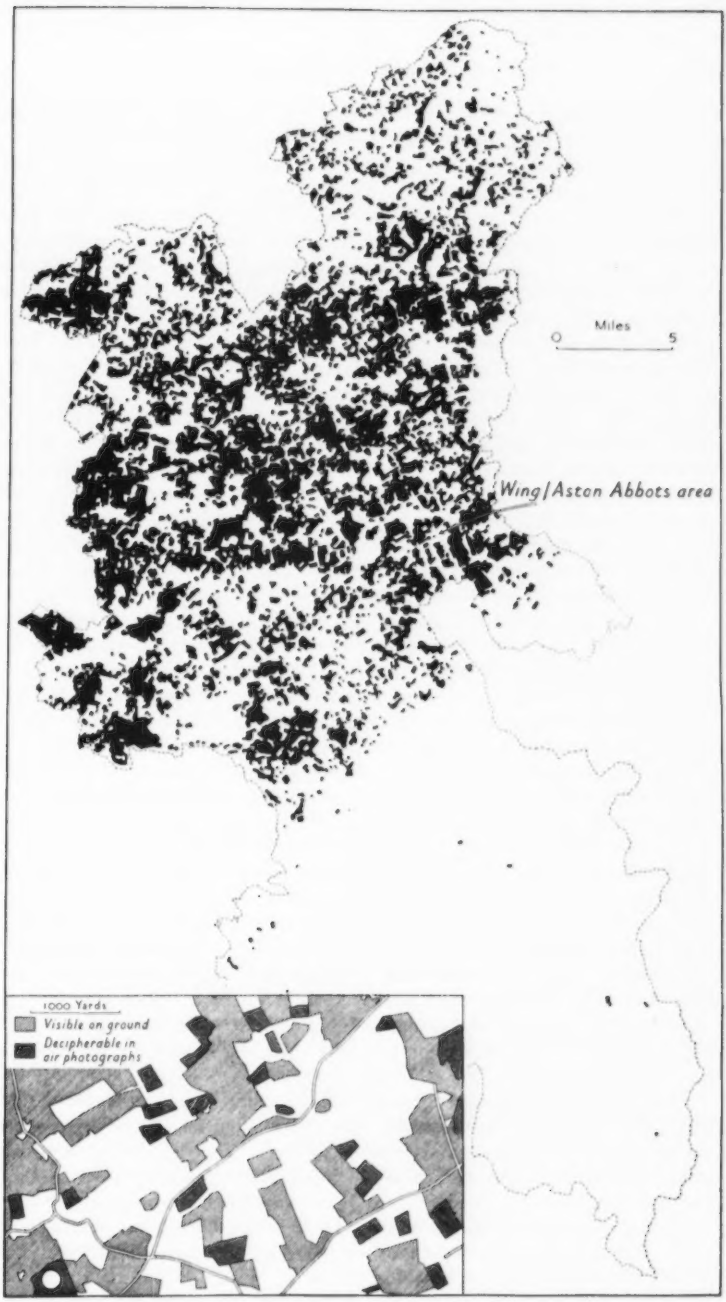

Fig. 2. Incidence of ridge and furrow in Buckinghamshire (Inset: detail in Wing/Aston Abbots area)

In short, ridge and furrow is most exceptional in the fields of the dip slope and on the gravels of the Thames valley to its south.

By contrast, the northern half of the county has a remarkably uniform distribution of ridge and furrow. Buckinghamshire north of the Chilterns is a land of clays rather than clay. The 5-mile-wide Vale of Aylesbury, developed against a background of Gault, is succeeded to the north by an interrupted belt of Kimmeridge Clay, a broad band of Oxford Clay and the spread of Boulder Clay which dominates the north of the county. North of the scarp, ridge and furrow is common to lighter and heavier soils alike, whether they be derived from the underlying rock or from the drift. The feature extends both over the heavy clays of the Gault and the well-drained outcrop of the Purbeck series with their Greensand cappings in the Winchendon area. The pattern is only recognizably absent from the Greensand of the Leighton Buzzard/Brickhill area. East of the county boundary however ridge and furrow reappears rapidly on their dip slope; while on sand and gravel patches west of Leighton Buzzard (*e.g.* between Stewkley and Soulbury), ridge and furrow is imprinted as firmly as on the clays. It is noticeable that ridge and furrow is frequently absent from the flood plains of the river valleys, *e.g.* the Thame and Ouse. Their water meadows have however been brought in part under the plough.

Bucks beyond the Chalk scarp displays a countryside far from contourless. The northern edge of the Vale of Aylesbury is a low, discontinuous chain of hills, of varying outcrops which broaden to the north-east in the watershed country of the North Bucks heights. This is a land of appreciable changes of relief within a short distance. But everywhere it bears the "finger print" of ridge and furrow. It is as prevalent on hill slopes as on apparently flat ground. Its grain is as often deliberately along the contour as it is athwart it (*e.g.* Wing Hill); although this may be an attempt to prevent soil wash.

The distribution of ridge and furrow north of the Chilterns is extremely fragmented. Figure 2 might have shown a more widespread and continuous distribution if it had been prepared in 1939 (and if, of course, an air survey had been available at the time). The extent to which evidence has been obliterated by war-time ploughing or reduced by bull-dozer for landing grounds (*e.g.* Cottesloe) is however relatively small. Quantitatively the area of detectable ridge and furrow north of the scarp is 28 per cent. of the superficial area. The surface area of Bucks north of the Chilterns is roughly 610 square miles. From air and ground survey at least 134 square miles of the county appear to have been imprinted with ridge and furrow for one or more agricultural reasons.

From the 1850 fields investigated by school children, several facts emerge. First, the range of widths across the back of the ridge varied markedly, from a minimum of 4 yards to a maximum of 18 yards. The most common width was 9 or 10 yards and just half of the ridge and furrow recorded on the ground survey was of this span. Ten per cent. had a wave-length exceeding 12 yards; 8 per cent. had a wave-length of less than 6 yards. There was no apparent association of different wave-lengths with particular localities. Because of the considerable divergence in wave-length and amplitude encountered it would seem reasonable to account for the feature by several explanations rather than a single one.

The analysis of a parish

A more detailed study of a single parish was undertaken to complement the broader county survey. Soulbury, a parish of 4226 acres on the Bedfordshire border in north-east Bucks, was chosen for the reason that it is one of the few parishes in the county for which a good pre-enclosure map exists. It is the "*Plan of the Manor of Soulbury situate in Buckinghamshire belonging to Jonathan Lovett Esq., surveyed and pland in the year 1769 by William Woodward.*" [1] The map is in good condition and measures 57 by 61 inches. Ink and colour can scarcely have been dry upon it before final enclosure occurred (by Private Act, 12 Geo. III, cap. 23, 1772). To reduce Woodward's plan to manageable proportions, it was traced, photographically reduced, redrawn and shown here as Figure 3. In the interests of clarity, lettering has been omitted from it (every strip holding and enclosure with the owner's name appears on the original). Several small detached holdings and outlying strips have also been left out. It will be noted that before the Act of 1772, a substantial area around "Liscombe Mansion House" (in the south of the parish) had already been enclosed.

A map to show contemporary ridge and furrow (Fig. 4), based on O.S. 25 inches to 1 mile, was prepared for comparative purposes. As with the county map of ridge and furrow it was the joint product of work in the field and on air photographs. There is good air photographic coverage from a single sortie flown in December 1946. The final 25-inch map experienced similar photographic reduction and was redrawn on a scale as near as possible to that of the 1769 map. William Woodward's Plan—probably prepared by chain and theodolite in the traditional eighteenth-century manner—shows surprisingly satisfactory concordance with the coordinates derived from modern survey. If compared with the contemporary map it will be found that the village pattern retains its essential features, that the distribution of settlement shows marked similarity and that the established framework of enclosed fields reveals little alteration. On the other hand, the system of communications has changed almost beyond recognition; while both canal and railway traverse the north-east corner of the parish. Natural drainage channels have been appreciably altered by ditching and straightening.

Detailed measurement of the Woodward map shows that just 33 per cent. of the area surveyed was enclosed in 1769. An additional 10 per cent. was neither held in strips nor enclosed and consisted of peripheral, fragmented common lands, drove roads and slades. About 57 per cent. was therefore held in open strip holdings. The strips were divided between the three traditional fields (Stonehill, Stapleford and West, by name) and two additional intakes, Hassocks and The Partables. Detailed measurement of the contemporary map reveals that a little less than 65 per cent. of the parish area bears evidence of ridging and furrowing. For the purpose of this investigation, however, it is necessary to disregard the full third of the area which was

[1] The map itself is a document but recently rediscovered. Its survival is fortuitous in the extreme; for it escaped a bonfire of deeds lighted by its eccentric owner and survived an auction sale of his effects. It was given to the safe keeping of the muniment room of the Bucks County Museum by the late Bishop Lovett of Salisbury in 1946. In its own right it is a fine local document which deserves to be professionally described.

enclosed before 1769. It is relatively easy to transfer the outline of the 1769 enclosures to the modern map. If this is done, two areas are defined on the contemporary sheet—an area of old enclosures with no less than 75 per cent. of its surface bearing ridge and furrows: an open field area, with somewhat less than 60 per cent. ridged and furrowed.

The open field area is of most interest from the point of view of this paper; for in it the nature of the correlation between the pre-enclosure holding and present-day ridge and furrow can be most satisfactorily examined. The measure of coincidence between the general outlines of the 1769 map and its twentieth-century counterpart is superficially high; but it is the general lines rather than the individual details which are responsible for this general impression. Where ridge and furrow exists, it is a common feature for the *fasces* of the furlong to be repeated in outline by a bundle of ridges. Upon closer inspection, however, the number of recorded holdings shows a relatively small agreement with the number of definable ridges. The difficulty of close correlation is increased, of course, by the nature of the early survey and its representation. The Woodward map usually represents property boundaries by a straight line whereas the present-day ridge and furrow frequently assumes a curved shape.

Stonehill Field, one of the most clearly imprinted ridge and furrow areas in Soulbury, provides the best unit for examination. It lies on the south side of the village—occupying a triangular area between two streams. The field embraces nine principal furlongs (see inset with Fig. 3 and Fig. 4). They contain from 5 to 50 strip holdings of varying width. The eighteenth century palimpsest shows through the present-day framework of the area under inspection. The Leighton Buzzard road has in part shifted its locality; but a clearly defined ridge marks its former course on the ground. A new road from Soulbury to Wing has been introduced. It branches at the south end of what in Woodward's day was called "Love Lane"; but the course of the old footpath is still traceable. Certain hedgerows are persistent and, save for localized straightening, the streams follow their same courses. Stonehill and Full Pit slades are also recognizable. In other words, the Woodward Plan can be readily compared by pin-pointing this evidence. The nine furlongs defined in 1769 can be approximately identified on the ground today. The superficial identity of the ridge and furrow pattern is near enough to suggest coincidence with the strip pattern. More precise investigation, however, yields the following results.

The *Long Furlong*, with 50 holdings identified on the 1769 map, would appear to contain certain of its original strips; but if closely examined on the ground today, the patterns of ridge and furrow and strip holding rapidly march out of step. In fact, the number of ridges in an identifiable Long Furlong is more than 60. *Fern Hook Furlong*, with 5 holdings in 1769, has a completely different ridge and furrow pattern today; although the directional "grain" is the same. *Hop Yard Furlong*, with 36 holdings in 1769, displays 45/46 ridges today. A series of new ridges appears to have been introduced which runs through into *Long Furlong*. A stream-edge field to the north of *Hop Yard Furlong* has a row of beheaded ridges revealed beneath the defining hedgerow. They do not match the present ridge and furrow of *Hop Yard Furlong*; though they were evidently at one time a part of its

e and furrow
/ Parish

RIDGE AND FURROW IN
BUCKINGHAMSHIRE
W. R. Mead

Fig. 3. William Woodward's Plan of the Manor of Soulbury, 1769

Fig. 4. Present day ridge and furrow in Soulbury Parish

RIDGE AND FURROW IN BUCKINGHAMSHIRE
W. R. Mead

complex. *Grange Furlong*, 28 holdings in 1769, is readily identified; but it has 34 ridges today. *Five Acre Furlong*, containing 6 holdings in 1769, has a ridge and furrow complex of 11 units today. *Stone Hill Furlong*, with 24 plus 3 holdings in 1769, is readily recognized today from its rights of way. Although there is directional similarity, the modern ridge and furrow pattern is not identifiable with the eighteenth century strip holdings. *Fullpit Furlong*, 32 holdings in 1769, shows the closest approximation, with a bundle of 31 ridges—the missing ridge may well have been lost in a new hedgerow. *Bottom Furlong*, with 8 holdings in 1769, has more than 8 ridges today. *Broad March*, with 8 plus 4 holdings in 1769, shows a bundle of 10 plus 7 today.

This area, which lends itself so readily to investigation, does not produce convincing evidence of ridge and furrow identification with pre-enclosure strip. Only one furlong out of nine provides the required correlation. On the other hand, present-day ridge and furrow complexes fit convincingly into the eighteenth century furlong pattern. This calls for two observations. First, Woodward's framework of open-field holdings may not have been a precise record of strips. Some consolidation may have taken place so that one holding embraced several strips.[1] Secondly, it may be assumed that the hedgerow pattern in Soulbury did not stabilize immediately after enclosure. Within enclosed fields larger than those of present-day Soulbury ploughing probably continued. There would be little or no point in ploughing against the open field "grain" of the land—or, indeed, against a pattern of runnels which intentionally or otherwise facilitated drainage. It is not inconceivable that the ploughman would multiply the ridges in his arable land *after* the initial enclosure but *before* hedgerow stabilization. Remembering the background of Revolutionary and Napoleonic Wars to Soulbury's enclosure, it is not unlikely that there was some continuity of arable practice before final grassing down. In the area under investigation, ridge and furrow seems to have undergone a change between 1769 and the time when the hedgerows finally stabilized.[2] The area of nine furlongs provides little, if any, evidence of deliberate ridging and furrowing to conform to an established frame of field boundaries.

Such final observations, however, are tied solely to the few hundred acres upon which the attention of this investigation is concentrated. They cannot presume to offer conclusions of wider validity. The method of investigation, if applied in a large enough number of cases, might justify some more scientific conclusions. But, even then, other corroboratory evidence is required.

The end of the beginning

This paper set out neither to answer questions nor to erect hypotheses. It is an essay on methods which the geographer might employ to supplement work of historians in a disputed field. Some new facts have arisen; but they apply only to the area from which they spring. They are facts which, through measurement, claim some degree of precision. But, in stating them, questions

[1] For a German parallel *cf.* A. Hömberg, *Beschreibung der Flurkarte von Eykse*, Berlin, 1944, p. 44, "Man sieht, dasz die einzelnen Bauern hier oft drei oder vier nebeneinanderliegende Beete besaszen." On the other hand, the strips illustrated on the Woodward map are usually of similar width.

[2] Unfortunately Tithe Redemption maps cannot help with an explanation.

are raised rather than answers given. The only indisputable fact is that all ridge and furrow land has at some time been under the plough. Most of it today persists under grass—at once complementing the present pattern of ploughland and recalling the former extent of arable farming north of the Chilterns. Ridge and furrow land in water meadow, reverted scrub and plantation hint at how much land marginal to present-day arable husbandry was under the plough. The plough produced the pattern and the pattern has raised the problem.

The pattern is not unique to England and the problem is not the sole concern of British investigators. Ridge and furrow is regionally distributed in both France and Germany, in a form familiar to the English eye. In France, the feature is especially noticeable under grass and in enclosed fields along the left bank of the Allier (*e.g.* the vicinity of Villeneuve-s.-Allier). In Germany, the feature has claimed particular attention in Bavaria. Indeed, the origin of German ridge and furrow was already taxing German historians over a century ago. Among more interesting and available contributions is that of Christian Frank.[1] Frank was among the enthusiasts who extended his field survey into farm labour. On 26 March 1910 he actually set himself the task of producing ridge and furrow with a plough to show how the hog-back ridge could be thrown up. German investigations into ridge and furrow have been more widespread and more speculative than British. A distinct nomenclature arose as a result of this Hochäckerkrieg.[2]

Before any firm conclusion can be reached concerning ridge and furrow origins, it would seem that there are three preliminary requirements—first, a large number of detailed studies which wed field observation to precise historical evidence; secondly, in so far as the material (especially cartographical material) makes it possible, the replacement of visual impression by mathematical measurement; thirdly, a scrutiny of the literature and methods employed in other countries where similar problems have been investigated and liaison with their investigators.[3] Clues which may help to explain ridge and furrow may come from many sources, *e.g.* soil science. The origins themselves may be several and not solitary. Perhaps not enough detectives have yet entered this popular new parlour game to provide solutions to a puzzle which even perplexed Alice in Wonderland.

[1] *Die Hochäcker*, Bibliothek für Volks- und Heimatkunde, 87, Kaufburen, 1912. Literature on the subject from 1829 to 1876 was listed in August Hartmann, *Oberbayerischen Archiv*, Band 39, p. 115 *et seq.* The practical creation of ridge and furrow for drainage purposes has been fostered in Quebec province. This treatment of arable land is popularly known as the Richard system, after a former director of the school of agriculture at St. Anne-de-la-Pocatière, P.Q. *cf.* O. Garneau, *L'Égouttement du Sol*, Quebec, 1943.

[2] On being shown Stonehill Field, Dr. Niemeyer of Münster immediately defined it an *esch* (an arable island, surrounded by common or meadowland in its original state, situated on light soil on slightly raised ground). This feature is discussed by H. Riepenhausen, *Die bauerliche Siedlung des Ravensberger Lands bis* 1770, Münster, 1938, 57–61.

[3] In Scandinavia, there is a school of enthusiastic investigators *cf.* in Denmark, C. Rise Hansen and A. Steensberg, *Jordfordeling og Udskiftning undersøgelser i Tre Sjaellandske Landsbyer*, Copenhagen, 1951: the investigations of D. Hannerberg at Lund University geographical institute and Eino Jutikkala's work in Finland—"How the open fields came to be divided into numerous selions," *Proceedings of the Finnish Academy of Science and Letters*, Helsinki, 1953.

SOME ASPECTS OF PROBLEM RURAL AREAS IN BRITAIN

G. P. WIBBERLEY

THIS PAPER DEALS with underdeveloped agricultural areas in these islands. It does not deal thoroughly with them—that would be too great a task to undertake at the present time. Yet during the past few years a small research group in the Agricultural Land Service of the Ministry of Agriculture and Fisheries has been making a number of investigations in the field of rural development, which are a step towards understanding our problem areas, and which form the theme of this paper.

It may be that this theme will be disappointing even to food conscious Britons. So many persons appear to have got into the habit of painting the problems and remedies of underdeveloped areas on a world canvas, or at least that of a continent. The Groundnuts Scheme, President Truman's Fourth Point and the Colombo Plan in South-east Asia have all had their share of publicity. Thinking big and wide is important in sketching out the framework of the world food problem, but sometimes the "global" approach is used as an excuse for lazy thinking, often to be followed by spectacular comment. It is a wide field where a single nought in a total figure looks unimportant and can be made to appear unimportant, and where the broad brush type of analysis often gives a definiteness and a simplicity to an area and to a problem which just does not exist in practice. Therefore, though a consideration of rural areas in Britain where all is not well may appear to be only a small canvas to examine, it should enable us to look at the problems in fair detail, and to concern ourselves with possible ways of making improvements and their probable costs and returns. There are (or should be) no political barriers to cross. There are no wide differences in cultural pattern, in language, in degrees of education and in basic social patterns when dealing with rural development within the confines of one long established political entity. There are, admittedly, differences in these elements between Celtic and Anglo-Saxon Britain—differences which prove awkward in getting ideas across and promoting action taken by local people. Yet these differences are minute as compared with the problems of grafting West European and North American ideas and techniques on to the cultural patterns of rural areas in Africa, South America and Asia.

When asked to define a problem area one is tempted to emphasize that it is much easier to say when an area does *not* appear to constitute a general problem. The latter type surely covers those areas which appear to have the capacity, both in their people and in their resources, to handle their own difficulties without recourse to outside help. They are the areas of which we hear little. They are not the subject of Royal Commissions of enquiry, examining committees or special legislation. They appear to adjust themselves to changes in political, economic and social circumstances with grumbles maybe, but nothing more. In contrast, problem areas are those

which do not seem to be able to solve their own problems either within their own boundaries or within the set of circumstances peculiar to the country at any particular point in time. There is then pressure, which ebbs and flows, to influence people in general and Parliament in particular, to busy themselves with the problems of these particular areas. This means that the general public hears a lot from time to time about such areas. They get into the arena of politics, into the national conscience like a small but deeply embedded thorn which, until it festers, only hurts when it is pressed on. Such areas in Britain include some of the older industrial regions like the South Wales mining valleys, east Lancashire and Tyneside. Many ordinary citizens would class places like these as areas "where something is always wrong." They include, in the rural sphere, the central uplands of Wales and much of the Highlands of Scotland—two general problem rural areas on which much has been and is being written and said.

Well-known rural areas such as these must be considered, but in addition there are rural areas in this country which can rightly be classed as problem, yet of which little is heard. Often their condition, weaknesses and strengths are documented, yet these are not spectacular enough to have caught the public's imagination or to appeal to the politician as ponds in which it would be profitable to stir. Even so, their possibilities—in agricultural production and in good living for people—are usually far greater than the rural blackspots most frequently highlighted in the press and Parliament.

It should not be necessary to explain why it is important to examine the use of the rural land of Britain; to see where and how improvements can be made in its short and long term use. Most thinking people are aware of this need, and the political and economic reasons which are forcing us to examine our own resources more closely and more critically. A critical approach towards land use possibilities is all important because together with the increased emphasis on home resources for both food and raw materials, there is a growing need for using carefully and selectively private and public supplies of capital, labour and materials. Too often the argument as to what Great Britain could produce in terms of her own food is over-simplified to the point that people seek and justify a simple proportionate figure. The questions often go like this: "If we are now producing about 50 per cent. of our total food from our own land could we produce the 100 per cent. If not, what should the target be?" If, in reply, one says that we would produce at home the amounts of selected foodstuffs which will give the best return on the capital, labour and materials which can be made available, one is likely to be criticized for talking and thinking like pre-war "laissez faire" economists. Yet surely there has been no change in the rules of logic since 1939. The balancing of competing claims for the use of the nation's resources in land, labour and capital is Britain's problem today as it was then. It is the relative strengths of the different claims on our resources which have significantly changed, particularly in the direction of the increased use of internal resources in land. But the time has not come (and should never come) for an indiscriminate approach to improved rural land use in Britain. The permanent expansion of an industry such as agriculture should involve constant care in seeing that injections of capital, labour and materials are applied to the

Typical reclaimable moorland in the Land's End peninsula, where agriculture is handicapped by rock below the surface. Such land is being reclaimed at about £30 an acre

"Cornish hedges" being built from the rock removed from the ground

Reclaimed moor, showing ploughland in middle distance, and three fields in front respectively one, two, and three year old leys

Guernseys grazing on a ley, one year after reclamation from moorland

most fruitful type of land, and that weaknesses in rural living are tackled side by side with basic weaknesses in the physical agricultural structure.

We should be concerned about two broad classes of problem rural areas in this country:

The first are those areas which appear to be close to the present-day margin of farming *and* living.

The second covers areas of naturally more fertile land on the lowlands which have severe or unusual handicaps to increased agricultural production.

Though the boundaries of areas of both types are necessarily indeterminate and change through time, they are sufficiently definite to be shown in Figure 1.

Marginality

In this paper we shall have to delve into concepts of marginality, because there are important differences between physical and economic margins in land use. The term "marginal" is also often very loosely used. We must, in particular, see clearly the distinction between the margin of cultivation and the margin of profitability. The former is always with us even in the most intensively cultivated areas and countries, though it varies greatly through time. All cultivated land touches or is surrounded by uncultivated land of one form or another—the rough grazings on the hills, odd uncultivated plots on lowland farms, tidal areas along the coast, and the outer suburbs of towns and cities. At any particular time the cultivated land adjoining that which is uncultivated could be said to be at the margin of cultivation. It is a fluid line through time because of the pressure of social, economic and physical forces.

One of these changing forces is the development of new techniques and systems of husbandry, which enable land previously beyond the margin of cultivation to be brought in. Then, in the light of the new knowledge (still perhaps in the experimental stage) the areas of uncultivated land throughout the country are re-assessed as to their potential production. Within reason, this is a useful starting point in looking at uncultivated land, but if it is handled uncritically it quickly becomes vague and useless. When pressed too far it merits the cynical answer "Oh, yes, we could grow grapes on the top of Snowdon if we really wanted to." Any person owning or using rural land is much more interested in the margin of profitability than in the margins between different levels or types of cultivation. A profitable farm or estate may well have areas of uncultivated land on it, and of late years hill sheep and cattle farms, with the greatest proportion of their area under unimproved rough grazings, have been often more profitable than farms on the lower plateau levels where all the land is cultivated. For example, published financial returns [1] from hill farms in Wales in 1949–50 showed an average of £320 net income per 100 acres (adjusted for rough grazings) as against £298 on the lower lying better quality Welsh uplands. The difference on a per farm basis was more than twice as great in favour of the hills. These lower lying farms on inherently more fertile land, in contrast with hill farms, have in fact, for a period, lain much closer to the margin of profitability, even though they have been much farther from the margin of cultivation.

The margin of profitability is essentially a short term concept as compared

[1] 'Farm Incomes in England and Wales 1949–50.' H.M.S.O., 1952.

with that of cultivation and, in particular, of potential cultivation. It is related, as Ashby and Britton have succinctly pointed out,[1] to many factors which can change in a relatively short time—relative price levels for agricultural products, size of farm unit, level of rents, personal efficiencies and

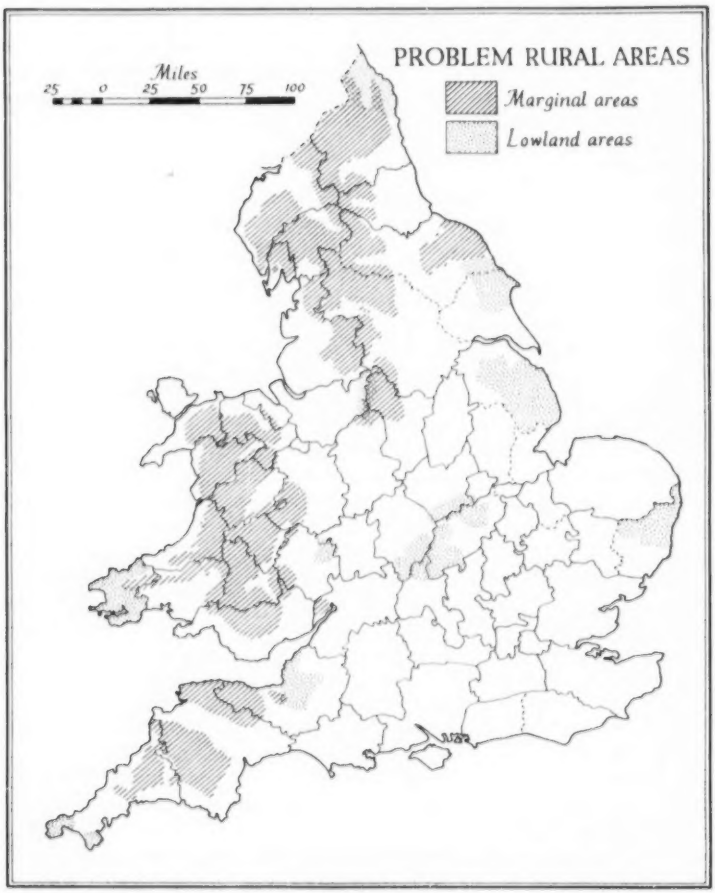

Figure 1

personal standards of values. The principal point of contrast and conflict between the two concepts is that what is profitable to an individual may be against the interests of the country or community, and that what a community wants done may well be distinctly unprofitable for a private owner or occupier

[1] A. W. Ashby and D. K. Britton. "Britain's Marginal Land," *Scottish Agriculture*, Vol. XXXI, 3 parts, 1951.

of land. If there is any bridge between these two separate ideals in land use—the gain to the individual as against the well-being of the community or region or country—we need to find it, as otherwise we shall not get far in working out practical steps to improve the use of underdeveloped rural areas.

The problem of areas on the margin of farming and living

Broadly speaking, these are found within and overlapping the land in Britain which has been graded as 7G and 8H by the Land Utilisation Survey. They lie, by another definition of Professor Ellison,[1] within the hill sheep and livestock rearing types of farming areas. Although marginal farms and land on the margin of farming and living are different things, it is likely that the great majority of marginal farms are to be found in these upland and hill areas where the inherent quality of the land is poor and where social conditions have always been difficult. (At least, this has been found to be the case in Scotland.)[2]

If we look at large parts of the Highlands of Scotland, the Border country, the Pennines, Wales and North Devon, we find a combination of high altitudes, rigorous climate, poor drainage and thin soils giving rise to poor land. These physical limitations affect the choice of farming systems, restricting it to types like sheep and cattle rearing which employ relatively few people. The land has been settled in the form of isolated farms and hamlets with few villages or towns. Accessibility is poor, and social and physical isolation, coupled with a history of low levels in personal incomes and living facilities for most of the rural population, have led in the past to a gradual loss of people; especially of the younger age groups. Many of the hard core areas of chronic rural depopulation are found here. The general result is not only fewer and fewer people living in the hills and uplands, but that an increasing proportion of those who remain are old people, disinclined to change. This ageing of the population has been common all over Britain but its effect has been more marked in isolated country districts.

In securing permanent improvements in the agriculture of such areas, only partial control lies within the agricultural industry. The earnings of owner and tenant and the wages paid to workers are internal matters. Yet living conditions lie partly outside the control of the individual farmer or landlord. Certainly, new cottages may be built on a farm or old ones modernized, and in some cases water and electricity from private installations can be and are provided. Yet there remains a variety of factors—frequency of bus service, distance of a school, shop or village hall—over which the individual farmer has little control.

It is foolish to expect or insist on the extended provision of public services and social amenities throughout the true hill farming areas of this country, as the population which the area can carry, unless there are activities complementary to agriculture, is too small and too scattered to justify them. It is therefore important that people in those areas should be able to earn an income sufficiently high and steady to enable them to improve their own

[1] W. Ellison, 'Marginal Land in Britain.' London, 1953.

[2] O. J. Beilby, "The Problem of Marginal Farms," *Journal of the Agricultural Economics Society*, Vol. VII, No. 4, 1948.

private living conditions, and to use public and private means of getting freely in and out of their houses or farms. Public expenditure on isolated schemes of improvements to farms and farm cottages in such districts as these can then be justified even though it may be divorced from any radical improvement to general social conditions.

In the uplands bordering the hills a different kind of curative treatment is needed. They have a greater density of population and often an agricultural potential which has been under exploited because of deficiencies of living conditions. Five of these deficiencies are vital, and they are supplied not so much by local private enterprise as by local and regional government bodies and public boards. These five are housing, piped water, grid electricity, schools and public transport. The total deficiency of these items over the whole of rural Britain is so great that it will be a long time before there are enough capital resources available in a nation as straitened financially as Great Britain is at the moment, to bring all rural areas up to the same standard. Some form of discrimination in the investment of capital seems therefore to be required.

In line with this trend of thought, a survey has recently been made by the Research Group of the Agricultural Land Service, of the upland livestock rearing areas of Northumberland in order to show the weaknesses and strengths of different parts.[1] The area was divided into a number of natural or physical units and the conditions in each of these were studied; a grading being given in respect of the following factors—land-quality, social provision, accessibility, educational programme, water-supply, electricity and farm labour trends. These factors were not thought to be all of equal significance, and it was necessary to establish some order of importance to resolve possible conflicts in the grading. The order adopted was that in which the factors have been listed. No statistical weighting was used, but where areas appeared to be similar in their order of priority they were graded after discussion with local people qualified to assess the problems of the particular areas.

Land quality was measured by a combination of a physical land classification and differences in "natural" grassland. Social provision included such things as numbers and types of shops available in the different villages and market towns, and the presence or absence of professional men like doctors and dentists. The relative accessibility of different places was measured by bus services and the distance from roads along which public transport ran. The educational policy of the County is important in that the present and future attraction of many villages and towns is being significantly altered by decisions as to the location of new secondary schools and the closing or improvement of certain village schools. In the provision of piped water and grid electricity, the authorities controlling these important services have very definite programmes and very definite ideas as to where it is and is not economical to extend them. Finally, there are big differences between farming areas in Northumberland in the history of their ability to attract and hold regular agricultural workers.

These factors combined give an indication of the strengths and weaknesses

[1] J. O'Connor and G. P. Wibberley, "Social Problems in the Development of Livestock Rearing Areas," *Agriculture*, Vol. LIX, 1953.

of different areas both as places in which to live and areas in which to farm. The areas are shown in Figure 2, numbered according to their attractive-

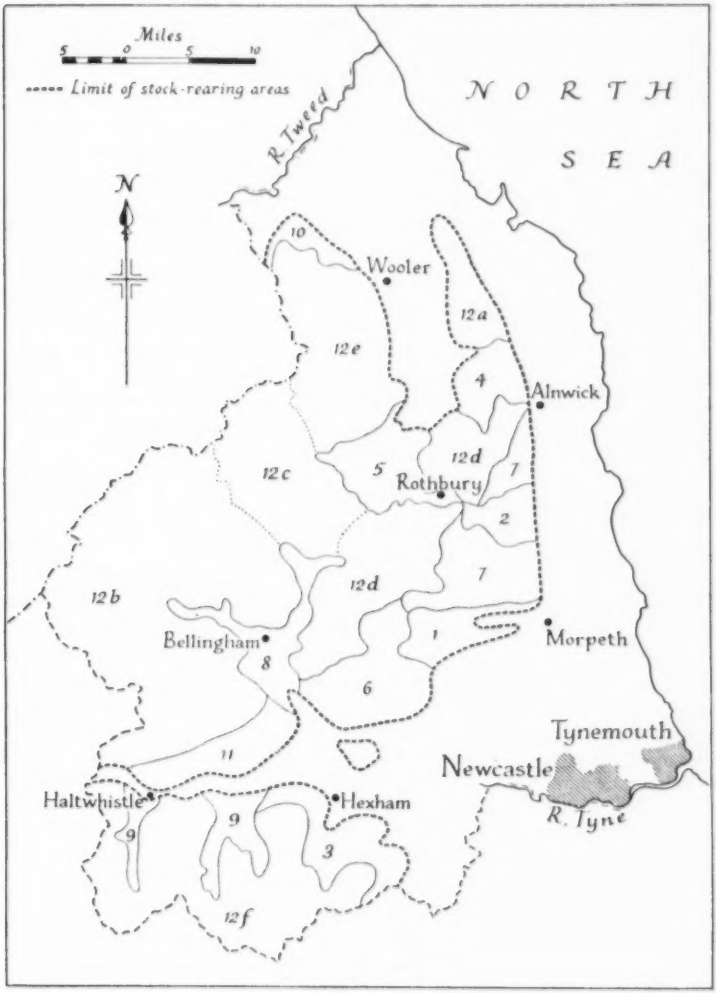

Figure 2

ness after considering all the factors mentioned above. At the top of the list was an area west of Morpeth in the Wansbeck valley where the only major weakness was in housing. This meant that a relatively small expenditure by society on one type of deficiency should lead to greater agricultural

productivity. In the middle of the list came Upper Coquetdale where a number of factors relating to inaccessibility (like long distance to schools and social facilities) were retarding the full use of agricultural land of fair quality. In the far north in the west end of Tweedside, an area even lower on the list, land quality is definitely good but it is underdeveloped because of a general lack of amenities. Here then agricultural improvement will depend largely on improvement to non-agricultural things like adequate bus services, stronger villages, and school opening rather than school closing.

The way in which this selective form of survey was done was rough, and the analysis could profitably be carried further by an assessment of likely costs and returns from the investment of community resources to one factor as against another, or to one area as against another. Yet it has value as a rural planning technique in both marginal areas and, with refinements, in other rural parts of Britain. It uses and integrates information which has been collected for other and separate purposes. It shows to each separate interest in a rural area—like a water authority, agricultural committee or the Forestry Commission—where its piece of the rural jigsaw puzzle fits in, or should fit in. It integrates and it selects, albeit in a rough way, and this surely is of value in preventing separate factions pushing in different directions with a consequent waste of public money or personal effort. Lastly, it is a type of rural planning that is basically an action programme rather than merely a permissive structure within which people are asked to conform. This type of critical approach has recently been applied in more detail by the A.L.S. Research Group to two of the factors in rural development—land reclamation and improved road access.

In the Land's End Peninsula [1] in Cornwall something like 10,000 acres of waste land, some enclosed and some open, lie in close proximity to productive farm land. Some of this land had been satisfactorily reclaimed in recent years and this prompted several questions. "Are there important differences in soils and climate between the waste land and nearby productive areas? Why did man in the past enclose much of this land and then allow it to run to waste? Which parts of it are physically reclaimable to-day? What would the reclamation cost? What would be the economics of reclamation to the individual owners and occupiers?" Briefly, we found that soils were uniform and that climatic differences were minor. A careful historical analysis showed that man's cultivation of certain portions and neglect of others arose primarily from a handing down from father to son of incorrect judgments of land potential.[2] The reclaimable waste land *within* existing farm boundaries was found to be 3251 acres, and the bulk of it at reclamation costs ranging between £20 and £40 per acre. Of the waste land lying *outside* farm boundaries 1272 acres were reclaimable, practically all of it at costs between £20 and £40 per acre.

It would have been of little value to have finished the survey of land reclamation at this point. What about the capability of the individual farms

[1] A.L.S. Research Group, "Land's End Peninsula—A critical Analysis of the Possibilities of Land Reclamation." Unpublished Report. M.A.F. 1952.

[2] Norman Hilton, "The Land's End Peninsula: The Influence of History on Agriculture," *Geogr. J.* 119 (1953) 57.

to reclaim waste land? A grading of each piece of reclaimable land was therefore made according to the possibilities of action in this day and age.

The farms and land concerned were graded thus:

Group I. Farms which have adequate fixed equipment to enable them to reclaim all the improvable waste land within their boundaries. These totalled 84 farms with 377 acres of ploughable waste land at costs between £30 and £50 per acre.

Group II. Farms which could reclaim their improvable waste land if capital were available for providing additional fixed equipment and for improving farm access. In this group were 54 farms with about 1000 acres of ploughable waste land at costs between £20 and £40 per acre. Estimated costs of building requirements on sample farms, when added to the land reclamation costs, showed a range between £45 and £89 per acre of land reclaimed.

Group III. Farms which cannot reclaim all their improvable waste land owing to major difficulties. Farms in this Group are generally larger than in Groups I and II. Reclamation of the wasteland is tied up with a number of problems, *e.g.* size of reclaimable area, farm layout, poor access, fragmentation and poor estate management over a long period. Twenty-nine farms in this Group contain 1644 acres of reclaimable land, the bulk of which is ploughable at costs of between £20 and £30 per acre. In the main report examples are given of ways of handling the problems on individual farms.

The reclaimable land outside farm boundaries formed Group IV—1300 acres of it with 900 acres ploughable, mostly between £20 and £40 per acre. Much of the reclaimable waste land in this Group is in large blocks. Some of these areas could be used as off land for existing farms; other areas would be best utilized if new farms were established. Nineteen small scattered patches could be reclaimed and farmed by adjoining farms in order to relieve over stocking on these farms.

In the report we tried to show by an analysis of farming costs and returns, that it would be profitable to occupier, owner and the nation if land of this quality could be reclaimed at £20–£40 per acre. The owners and occupiers of land in Groups I and II, in particular, have the help of the various forms of state assistance, like ploughing grants, Marginal Production Scheme, improvement loans, water, housing and drainage grants and income tax reliefs and allowances—all already in existence. In contrast the reclamation of land in Group IV involves fundamental problems of reallocation of land and the provision of a new public road and other services. The value of sorting out the worthwhile land in these four groups was that an immediate start could be made on bringing more land into cultivation on Groups I and II farms, whilst the more difficult policy angles involved on the land in Groups III and IV could be debated. This is exactly what has happened since the report of survey was made. New land is being brought into cultivation at this present moment on Group I farms. An effective policy to help in the provision of new and better fixed equipment on Group II farms is close to a decision, and the major problems of Groups III and IV have gone to join the records of other pieces of agricultural land in this country where new policies are needed before their problems cannot be effectively solved.

Figures 3 and 4 illustrate the types of map which were prepared in the course of the Land's End Survey. An up-to-date Land Utilization map was first compiled from field to field survey, and from this the rough grazings were extracted and classified according to their reclamation possibilities and estimated costs. The assessment is shown in Figure 3, but for convenience the ploughable land has been shown in only two generalized cost groups. Figure 4 shows the land which was actually assessed as reclaimable, subdivided as outlined in the above paragraphs. In essence, therefore, the Land's End Survey and the Northumberland survey were alike in that they were geared to present-day legal, administrative and financial arrangements for making things happen in the countryside.

Throughout rural Britain and especially in the low-lying plateaus there is a network of minor roads serving farms, isolated cottages, hamlets and cottages. Adequate for pony and trap and horse and waggon in the days of our grandfathers, the advent of the car, tractor and motor lorry is emphasizing their narrowness and breaking down their lightly made-up surfaces. Yet the cost of road repairs to withstand modern transport is mounting, and all types of road, from the contemplated new motorways, through existing main roads, to these rural lanes, are crying out for the expenditure of more public funds. There does not appear to be enough money to maintain surfaces, much less to improve all roads in all areas. Is there any way of choosing the minor public roads which are of most importance to agriculture so that restricted monies for road works are not misapplied?

A study has recently been made of the effects of unsatisfactory public roads on agriculture, with special reference to parts of Central Wales and the North Yorkshire Moors.[1] It showed that the problem of poor minor roads is worse in the moderately high peneplains than in the hills proper. Yet the type of farming practised there, measured by the things which enter and leave each farm, needs only a type of road which can be narrow, and a type of surface adequate only for light and intermittent traffic. Such a light road can be laid across a new route or produced from many existing lanes at a minimum cost of about £2000 a mile. Though this figure is extremely low in comparison with costs on most other classes of road, it can only fall into its true perspective when measured against the value of the land which it will serve. At the present time a technique of comparative valuation of road cost and land improved in value thereby, is being tried out on an experimental basis. In addition to the difficulties of assessing the potential output from land when road access to it is markedly improved, there is the further problem of making a correct allowance for the social value of minor rural roads, as distinct from their present and potential agricultural value. In our present state of knowledge a rebate of one-third of the total annual road improvement costs allowed for social reasons seems to make sense when applied to farms in the uplands which, to-day, are obviously on the margin of both farming and living.

Before leaving this necessarily incomplete discussion of problem areas on the margin, something should be said about the population picture. It is

[1] A.L.S. Research Group, "The Effects of Unsatisfactory Public Roads on Agriculture." Unpublished Report. M.A.F. 1953.

quite obvious from Dr. Willatt's paper on Population Changes given to this Society in February [1] of last year that most of these marginal type areas are also the "hard core" areas which have consistently lost population since at least 1931 or are those where a long term decline has been reversed only very recently. Yet, on examination, the relationship between agricultural productivity and rural depopulation is far from being clearcut. When measured against the inherent fertility of the land, farm output from many of these marginal areas has increased in recent years in line with the national increase in agricultural output. In fact, a recent A.L.S. investigation into the relationship between depopulation and agricultural production in the Lincoln Wolds [2] suggests that where the physical agricultural structure is well laid out, new techniques which are increasing output per man, are enabling productivity to be increased despite the thinning in numbers of the local rural population. On poorer land with an emphasis on smaller family farms, continued rural depopulation weakens the supply of hired farm workers, but this is of minor importance as the farming economy is built on the farm family.

General movements in rural population appear to give little direct guidance as to areas of unusual agricultural difficulty. Changes in the occupational structures of thinly populated rural areas are, in contrast, much more closely linked. In parts of central Wales (and it is probably true for many other upland and hill areas of Britain) the sharp edge of rural emigration lies in the greater loss of non-farming people—from isolated cottages hamlets, villages and small country towns—as compared with the slower movement of people from direct agricultural employment on the farms. Areas in the uplands and also in a number of isolated lowland areas are becoming more and more dependent on the one occupation of agriculture. The evidence collected in the Lincoln Wolds study suggests that by 1970 local agriculture will have to take 70 per cent. of the total number of men of twenty-one years and above in the area, if it is to maintain its existing regular farm labour force. There will therefore be precious few men left for other forms of employment if things go on as they are.

There are obviously important but involved relationships between changes in the numbers, age and occupational structure of the population of rural areas, and many of the psychological and social barriers to increased agricultural productivity. What they are I do not know. Here is a large and important field of enquiry which should be tackled. This work should go on side by side with the study of improved agricultural techniques and the better use of resources within the individual farm.

Difficult "lowland" areas

These are areas of inherently more fertile land in lower-lying areas which have severe or unusual handicaps to increased agricultural production. They do not have any general similarity such as that existing amongst marginal areas, and no description could be given which would be generally applicable

[1] *Geogr. J.* 119 (1953) 431.

[2] A.L.S. Research Group. "The Lincoln Wolds. The Effects of Rural Depopulation on Agricultural Production." Unpublished Report. M.A.F. 1953.

to all. Here we are dealing with problems rather than problem areas—excessive farm fragmentation in one area, a severe and complicated land drainage problem in another, elsewhere a traditional farming pattern and philosophy out of line with present-day needs. Though these problems appear, at first sight, to lie within the agricultural industry, they often lie outside the control of the individual farmer or landlord, and their improvement affects the whole social fabric of certain rural areas. And though these appear to be special and individual problems, a high proportion of them are occurring today in one region of England—the Midland counties.

Many of these problems have their genesis in the strains and stresses occurring within the physical farming structure and rural settlement pattern of much of lowland Britain. It is in general true to say that we are producing food in the middle of the twentieth century, with an agricultural structure designed and built for the conditions of the mid-nineteenth century. Then, hand work and horse work were all important on the farm, and each was relatively plentiful and cheap. The urge to lay out farms and farm buildings to economize on these two forms of "power" was therefore weak. Right from the beginning of the enclosure movement there were restrictions as to the practicability of designing farm shape and size according to the type and quality of land and variations in farming systems. In Anglo-Saxon Britain, though much of the better land was cultivated in the open fields and the poorer land on balance lay in the unenclosed wastes; the enclosure of the open fields and their division amongst a number of persons with buildings in the village, led immediately to compromise decisions not intimately related to the most desirable size, most suitable layout, or soil type. Only in the enclosure of the wastes could farm shape and size be decided fairly free from conflicting personal claims. Through the long period of enclosure and since, farm shape, size and ownership have been pulled this way and that by forces such as whims of inheritance, short-term land speculation and, to a minor degree, changes in agricultural techniques and profitability of different farming systems.

There has been surprisingly little systematic study of farm shape and size in this country. For what there is we have to thank the geographer—both historical and economic. We have no really useful measures of the changes occurring, the forces behind them and their relation to agricultural efficiency. There have been a number of changes in farm shape and size over the past hundred years. In a recent A.L.S. study of the agricultural structure of certain Midland Parishes,[1] sufficient information was found to show that over the period 1838 to 1951 in two of the parishes: (*a*) the number of farms had fallen from 72 to 46; (*b*) the average size of farm had increased from 75 to 111 acres; (*c*) the number of fragments of agricultural land had decreased from 162 to 67; (*d*) the average size of each fragment of land had grown from 33 acres to 76. These changes had occurred over one hundred and twelve years, and the proportion of them occurring since 1941 was surprisingly high. They superficially suggest that big improvements have taken place in the efficiency of the local agricultural structure, in that fewer farmers are farming

[1] A.L.S. Research Group. "A Study of the Agricultural Structure of Four Midland Parishes." Unpublished Report. M.A.F. 1951.

larger farms comprised of fewer parcels. Yet this survey went on to show that the present-day structure of these four Midland parishes is still full of weaknesses—particularly in relation to present-day techniques and agricultural policy. The more important of the findings were:

(1) That the higher standards of farming were to be found on the farms which were largest in size, had the best farm layouts, the better buildings and the more straightforward owner-occupier relationships.

(2) A measurement devised to know the degree of convenience in farm layouts showed that only 23 farms out of 66 could be classed as "good." This proportion of 35 per cent. should be contrasted with the farm layout analysis derived from the results of the 1941–43 National Farm Survey.[1] This showed, for England and Wales, a proportion of 54 per cent. as "good." It is believed that this figure of 54 per cent. is much too high, as that survey was done by local surveyors with local standards as to what constituted a good layout, and there was no standardization of assessment from one county to another.

(3) The best laid out farms in these Midland parishes were those with their farmsteads away from the villages.

(4) There was a general improvement of farm layout with increase in farm size. This supports the general conclusions of the 1941–3 National Farm Survey.

(5) Farm buildings were nearly everywhere poor when carefully appraised according to range of facilities available, age and suitability for present-day needs. Whilst good and bad sets of buildings occurred in both villages and in isolated places, it was significant that all the newest improvements of late years have taken place on the isolated or "lodge" farms. Yet against this, the village farms had the advantage in many cases of better electricity, water and sewage facilities and in all cases, of easy access to hard roads.

(6) The state of land ownership was very complex. With the exception of a few large estates, the farms were held by owner-occupiers (many of whom seemed quite content with the bad condition of their fixed equipment) or by tenants who had difficulties arising from impecunious landlords and divided ownership. Any attempts to alter farm size and layout without altering the ownership would just make the tenure pattern even more complex and unsatisfactory.

How far are these findings from a few parishes in the English Midlands symptomatic of a general problem? It is difficult to be certain because there is so much more work of this kind to do. Yet certain analyses made with the data collected under the 1941–3 National Farm Survey, supplemented by returns on tenure from farms in March 1950 give this broad picture.

About one holding out of each four (or 70,000 holdings) in England and Wales has its land severed in one or more places. The greatest proportion of these severed holdings exist in the old Anglo-Saxon areas of England, being linked with the farms which have their farmsteads inside nucleated villages.

[1] 'National Farm Survey of England and Wales. A Summary Report.' H.M.S.O. 1946.

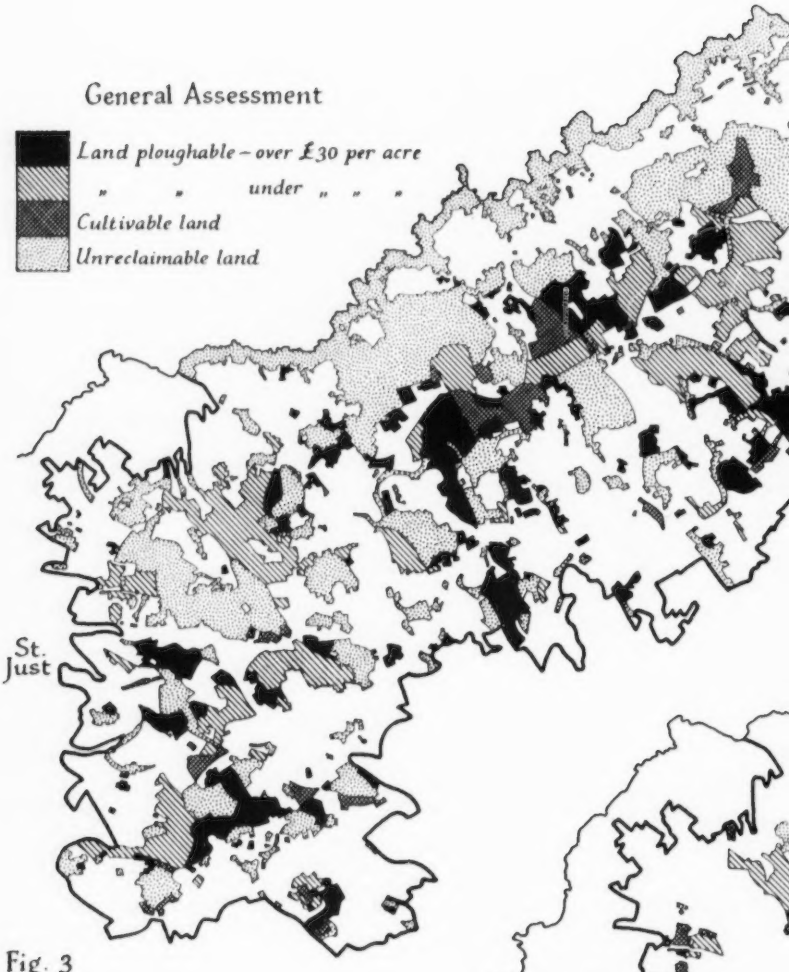
General Assessment
Land ploughable – over £30 per acre
" " under " " "
Cultivable land
Unreclaimable land
St. Just

Fig. 3

St. Just

Fig. 4

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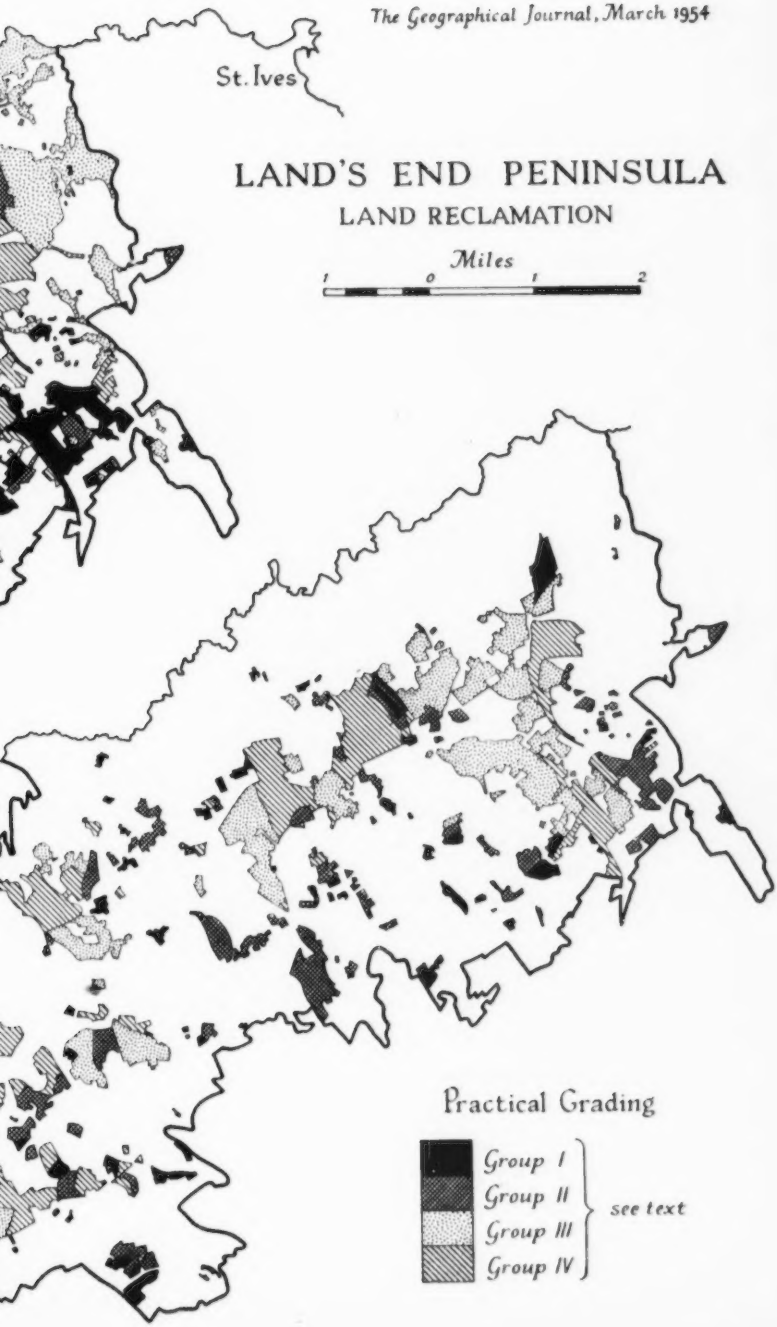
St. Ives
LAND'S END PENINSULA
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About 133,000 holdings were judged in that Farm Survey as fair or badly laid out. This is nearly one-half of all farms over 5 acres. It is believed that a more systematic measurement of farm layout would bring this proportion nearer the two-thirds mark. There is thought to be a very high correlation between the quality of a farmer, the situation and layout of his farm, and the nature of his tenure.

Enough has been said to show that there are severe handicaps in our existing physical farm structure, that many are linked with the existing rural settlement pattern and that the defects are emphasized throughout the Midlands of England. Though changes are taking place in this farm structure they are slow and many are not related to farming efficiency. The increase in owner occupation too, which seems to be occurring (36 per cent. of all holdings in 1950 in England and Wales) does not promise any material improvement in the situation—in fact it may make desirable change in farm structure less likely. In addition, any increase in mixed ownership and in the number of small landlords are likely, as judged by their effects in the past, to produce changes of a bad character, together with increased rigidities.

Many questions, to which we do not know the answers, arise when thinking about this problem. To what extent is the best use of land within rural Britain being prevented by the accident of its occupation and ownership? A degree of extra cost in food production must arise through bad farm layouts, size and provision of fixed equipment. How serious is it? How does it compare with the probable administrative and other costs of attempting improvements in farm shape and size through democratic processes? Are we reaching the limit of effectiveness of technical improvements in farm husbandry because of these rigidities and faults of the physical farming structure? If so, where exactly are the areas and how high is their farming potential if reallocation of land was carried out? Should we not find out the easiest areas to tackle first, where a few changes would bring immediate benefit, before plunging into the really badly fragmented areas?

Much thought and practical work has gone into the problems of farm reallocation in other democracies—particularly in Holland, France, Switzerland and Sweden.[1] Admittedly, the degree of farm fragmentation in parts of these countries has been such as to force local and national attention on to the problem. Here in Britain, there has been no awakening of national or local conscience on the problem, and the first attempt to suggest a voluntary rearrangement of farm land in a small area in Dorset [2] has foundered amidst a welter of legal and administrative difficulties and both local and national opposition. Surely our first step is to assess correctly the real costs and hindrances which our inadequate physical farming structure are imposing on us in different areas, and then make people aware of them. This can only be done by methodical fact finding and assessment. In other countries where cautious but steady steps are being taken to improve farm shape and size, it has been found essential to demonstrate the weaknesses of the present layouts

[1] "The Consolidation of Fragmented Agricultural Holdings." F.A.O. Washington, 1950.

[2] Agricultural Land Commission. "Yetminster Farm Boundary Report." H.M.S.O. 1952.

and the benefits of new boundaries to local owners and occupiers so that they finally agitate for their own improvement schemes. This takes work, care and time. An official working on this problem in Holland once said to me: "We find that it takes about one year between a rationalization scheme being suggested and a scheme being put forward by local people, with the support of the majority. The scheme has got to become their scheme, otherwise we think we have failed to do our job properly." To quote Lilienthal of the T.V.A. experiment, it is in the "grass roots democracy" part of rural development that we in Britain appear to have much to learn.

After a few bad starts we are beginning to do better in the reallocation of land at the margin between forestry and hill farming, especially in the North Country and Scotland. Local opinion is being carried along with the new scheme of things, and local physical and social services are improving because of the larger and more mixed population now living in those areas. But no major attempt has been made in the more thickly settled areas.

There is abroad an air of defeatism about the rationalization of our physical farming structure. The administrative, legal and financial hindrances to action loom large, but it is surely not true that nothing can be done about it. If full factual knowledge is obtained, and farming and public opinion is convinced that there are worthwhile gains in agricultural efficiency from action in this field, then all the necessary legal, administrative and financial arrangements can be made in the same way as has occurred in other West European democracies. Are we incapable of making a new enclosure movement if such should prove to be desirable?

Priorities in rural development

An expansion in agricultural output, an increase in rural incomes, and improved standards of living in the countryside could be attempted by one or a combination of various policies:

1. The setting of high minimum price levels for the main agricultural products relative to earnings in other industries, with taxation designed to float off the surplus income of the owner and occupier of good farms on fertile land.
2. More moderate national price levels for the more important farm products, with the smaller farmers and those on the poorer land helped through a series of subsidies and grants which the nation writes off as being part of the total cost of producing food in this country. This has been, in essence, the post-war approach to agricultural expansion in this country.
3. Prices of agricultural products being allowed to vary freely according to conditions of supply and demand, with the ownership and occupation of land remaining a free market.
4. Agricultural land being re-rated or a land tax imposed which would reflect, even if it did not accurately measure, differences in the inherent fertility of land.

There is not space in this paper to delve into the ways in which each of these policies or combinations of them could be evolved, or to ponder how they would be likely to work out in practice. For good or ill, both of the major

political parties in this country have decided to adopt the second approach, by which to secure a continuing expansion in agricultural output, an increase in the area under cultivation, and improved efficiency in food production. Those who quarrel with this choice and look askance at the many complicated parts of the administrative and technical machine set up to carry out this policy, should be careful not to jump to the conclusion that any of the alternative policies would necessarily be more effective in raising both the output and efficiency of British agriculture. High national price levels can entrench inefficient producers, create unmanageable surpluses of individual products and be very expensive to the general body of consumers. Certain aspects of American and French experience in this connection are worth looking at. "Free" price levels for farm products and for farm land can produce farming uncertainty, depress some sections of the industry, and encourage speculation and excessive fragmentation of land. An agricultural land rate or tax looks, on the face of it, to be a useful spur to both increased output and efficiency in that it should put the owner and occupier of both good and poor land on their mettle. Whether or not a fair land tax or rate could be worked out and applied is more problematical. Lloyd George's land tax came to grief in the early 1920's because it was judged to be administratively unworkable, and this country appears to have decided through many years not to accept or implement the ideas of Henry George.

At present then, we appear to be committed to a definite expansion programme in agriculture in Britain which is a combination of price stimuli, tax reliefs, and grants towards a mixture of items related to both husbandry and farm fixed equipment. These all emanate from a legal framework giving security of tenure to the agricultural occupier of average ability or better, and which provides machinery whereby occupiers and owners who shamefully neglect their land can be dispossessed. As this policy has progressed and matured and been given twists and emphasis in different directions since 1939, the "stick" of ultimate dispossession has remained the same, whereas the "carrots" of incentive have become many, and of all shapes and sizes. Though most of this help has been directed towards the individual farm farmer and owner, the concept of discriminatory help to agriculture is now spreading to the consideration of farming areas *as well as* to individual farms, and to rural social conditions *in addition* to land and husbandry improvements. Substantial increases in farm output have been obtained by straightforward financial incentives and the spread of new farming techniques. The maintenance of this increase, a further advance on it, and progressive increases in the efficiency of production are proving much more difficult and much more complicated tasks. We are meeting psychological and social difficulties, and problems outside the farm gate as well as inside it. That is why there is a need for the type of wide, yet selective surveys and analyses which have been dealt with in the foregoing pages.

DISCUSSION

Afternoon Meeting, 23 March 1953

Before the paper the CHAIRMAN (Dr. E. HINDLE) said: I remind you, ladies and gentlemen, that our lecturer, Dr. Wibberley, was in 1949 appointed head of a Research Group in the Agricultural Land Service. The Group has one or two representatives in each of the seven Land Use provinces in England and Wales. For a time, the greater part of that work was carried out in connection with the preparation of the Development Plans, such as the surveys of agricultural land in the vicinity of urban areas. The work of the Group is developing mainly along three broad themes:

A. Studies involving the encroachment of non-agricultural interests on agricultural land;
B. Investigations covering the better use of land which is on the margin of farming and living;
C. Investigations in "problem" areas located on our better land where, because of certain defects in the physical and social structure, the agricultural potential is not being realized.

The paper to be read this evening, is an account of the Group's work in some of our problem marginal areas—both upland and lowland. In the case of the former, studies made in Northumberland and the Land's End Peninsula are quoted as examples of the techniques evolved; for the problem of lowland areas, the speaker will present a picture of typical conditions that exist in some of our Midland counties.

Dr. Wibberley then read his paper

The CHAIRMAN: I am sure you all agree with me that there is no necessity for the lecturer to thank the Society, because we are all greatly indebted to him for coming here to give an account of such an interesting and important problem from a national point of view. I wonder if Professor Wooldridge would care to start the discussion?

Professor S. W. WOOLDRIDGE: I would like, Mr. Chairman, to pay a tribute to the value of the work done by this Research Group of which Dr. Wibberley has spoken. My own knowledge of the subject amounts to being on the boundary during discussions under Ministry auspices. I feel then as a free-born Briton, a taxpayer and a ratepayer, that I have the right to see what is going on; and I would not allow any of my administrative colleagues to tackle the problem of British agriculture without this type of factual survey.

The question so often asked in regard to enquiries of this nature, which is a red rag to the scientist, is the innocent one: What are you trying to prove? Such an enquiry does not try to prove anything for enquiries of this type are fact-finding; they are designed to show the complexity of the problem before other persons dare to muddle it, or even to consider it.

The maps which Dr. Wibberley showed were valuable to any research projects which they are designed to illuminate, and are also pieces of excellent regional geography. I react very favourably to a remark made by Dr. Wibberley almost in an apologetic tone when he said that although these were detailed local maps he dared to add that they had reference both to the area and the world at large. I like that note of contradiction in this Society. I have dared to say that we appear sometimes much more interested in the human geography of Somaliland than of Somerset, whereas we are, of course, interested in both.

I am grateful to Dr. Wibberley for showing some of my own associates just what is the complexity and what are the intellectual difficulties of geography right here at home. I would like to see in letters of fire sometimes when these matters are under discussion the words of my favourite text: "Wisdom is before him that hath understanding; but the eyes of a fool are in the ends of the earth."

Dr. Wibberley has raised so many points that it would not be fair and proper for me to stand in the way of other speakers. As to rural marginality, a real red rag between geographers and economists, Dr. Wibberley has put the issue very clearly. May I conclude, sir, by expressing my very great personal thanks to Dr. Wibberley and my satisfaction that this first-class work should become known to many of you who might not otherwise get in detail the three studies of Northumberland, Cornwall and the Midlands.

Dr. O. W. PRICE (Agricultural Economic Research Institute, Oxford): We at the Institute are very interested in Dr. Wibberley's work and I feel sure he will excuse us this evening for tending to underline the agricultural aspect about the problem more than he has himself done. He has pointed out that marginality in farming is an economic problem; its roots might be physical and social, but the policies have to be economic, and he has said that the purpose of his work is to provide a basis for drafting such policies. But in discussing his survey of Northumberland it seems to me that nevertheless he has forgotten the economic aspect in his survey. The factors considered gave very heavy weight to density of population, accessibility, nearness to schools and water supply. Many of these coincided with each other and were measures of density of population. But he did not, in fact, give sufficient weight to the economic factor.

There is danger in this because Dr. Wibberley recognizes that his surveys are meant for policy formation and up to now marginal farm policies have been based on physical *criteria* of altitude and so on and grants have been given on this basis. But let us take some of the so-called marginal areas of this country; for example, the type of country referred to in central Wales. The upland areas there have been receiving subsidies and grants for the last twelve or fifteen years and the farms remain as marginal as ever. In an income of £300 a year, £100 is subsidy, so that if those farms were not receiving a subsidy it would mean that in all probability they would have gone out of business long ago. As it is, the amount of the subsidy just keeps them going; it does not allow them to put in capital or reorganize the farms. It seems to me it should be the policy of the Government to define what it means, from the economic point of view, by marginality, and then set about to eliminate it. The purpose should be the receipt of an income in farming which can be sustained.

There was a point raised of Lilienthal, which I will not reiterate. But it reminds me of an experiment in his country to attempt to change farm boundaries which failed in large part because it was not accepted locally. The attempt was made from above, and the plans put on the local farmers without first educating them. Lilienthal emphasized that before any plan can succeed it must first have public acceptance. I do not recall whether Dr. Wibberley has made this point, but it is an important one in relation to effecting a change in land utilization.

Mr. J. R. JAMES (Ministry of Housing and Local Government): I am very pleased to hear of the great quantity of work which Dr. Wibberley and his staff at the Ministry of Agriculture are doing, for it ties in closely with the work of county planning authorities who are engaged, under the Town and Country Planning Acts in the framing and execution of a policy for the use and development of land. It is good that much of Dr. Wibberley's work springs directly from the interests and responsibilities of local people to see the local problems now

put before us in a national context, to discuss them with Government Departments and amongst themselves, even to become articulate about them, probably for the first time. It is right that this work on Northumberland was largely done with the county planning authorities.

Some masterly black-and-white maps have been shown dealing with public utilities and services, population, types of farming and categories of land. I could have wished for one more map, one showing the boundary of the Northumberland coalfield. This is the critical line in the human Geography of Northumberland; the industrial areas to the south and east of this line have a dense population and the farms are well serviced; the wild hills to the north and west have few people and the scattered farms practically no amenities. The problem areas lie along this boundary. They are areas of marginality where, in these days of financial shortage, a small investment to provide the services necessary to rural life may well tip the balance between contentment and full use of the land or, failing such support, unrest, depopulation and decline of farming.

Dr. D. R. DENMAN (Department of Estate Management, Cambridge): One point in particular has impressed my mind. I think I am right in saying that when Dr. Wibberley referred to categories of land determined according to their need for improvement, he said one of the reasons for some of the worst cases of under-equipment was the existence of impecunious landlords. I wonder how Dr. Wibberley determined what was an impecunious landlord and how he got his information! He certainly put his finger on a vital spot, though it is difficult in such surveys to find that spot.

Dr. WIBBERLEY: Let me touch a little more on marginality, not so much to disagree with Dr. Price, but rather to say that he expected from the Northumberland survey, as others have done, just too much. It was really a technique whereby one could work out first, the area where things seemed to be wrong, and secondly, the type of factor that seemed to be weak. Within particular areas and on particular factors more investigation might then be needed.

I tried to illustrate this second stage by saying why the question of land quality should be looked into in more detail in the Land's End peninsula. It is necessary to know where the difficult areas are, particularly the difficult areas that have possibilities. I am not interested in difficult areas which are, when looked into, even more difficult; we want difficult areas which have potentialities, and they need sieving out. The Northumberland technique was a rough way of doing that. It could have been improved and better explained, as Mr. James has said, by relating it to other more agricultural factors. Then it can be taken on a further stage, as we did at Land's End when we tried to tackle economic marginality in relation to physical marginality. I hope more and more of our work will be done in regard to this whole question of land priorities and that we will be judging more and more from the economic point of view, so that we can get some sort of balancing yardstick for the intangible social and psychological factors.

I agree with Mr. James that these problems arose because of the work of the local planning committees. That is the sort of two-way traffic between the research organization and the local planning authorities which could be developed in future, particularly during the next five years when they are looking outside their major towns into their rural interests.

We had no special technique for deciding what is an impecunious landlord, except that one does hear a good deal of gossip in various areas.

The CHAIRMAN: Ladies and gentlemen, before we leave I feel sure we all wish to express our hearty thanks to Dr. Wibberley.

MORPHOLOGY OF THE NORTH BOULONNAIS CHALK

A. COLEMAN AND A. M. FERRAR

THIS PAPER OFFERS a summary of field observations made in the Boulonnais, the detached French end of the Wealden dome (Fig. 1). The northern Chalk cuesta, which is our main concern, is the structural continuation of the North Downs, but in its length of 30 miles it shows more diversity than any comparable Chalk tract in England (Figs. 2 and 3). It is bordered on the north by the Flanders maritime plain, and on the south by the irregular hill country of the Bas Boulonnais, where erosion has penetrated through the unusually thin Lower Cretaceous and Jurassic Beds as far as the Palaeozoic basement, and destroyed all trace of the concentric symmetry of the Weald, except in the encircling escarpment itself.

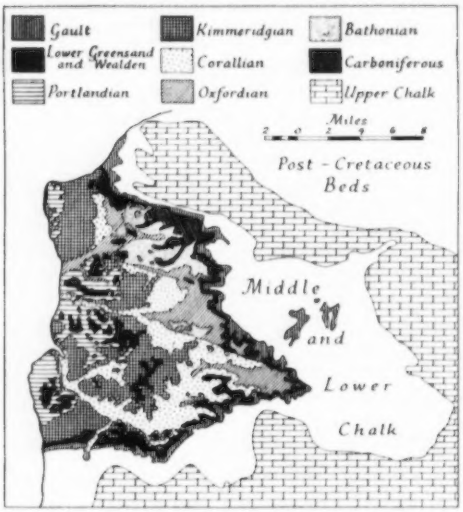


Figure 1

Structure

Three sets of structures affect the Boulonnais. The intense Hercynian contortions are mostly buried, and are of little immediate relevance. The post-Jurassic folds and faults are much slighter, but their south-east and east-south-east grain has guided the rivers and so influenced the moulding of relief (*cf.* W. Topley, 1875; P. Pruvost, 1924; W. B. R. King, 1949). The structures found in the Chalk are Alpine in date, and lie in close posthumous relationship with the Jurassic axes. They have been examined in detail by A. Briquet (1922, 1931). The main Boulonnais fold pitches eastward and is asymmetrical, being steeper to the north. Hence the southern escarpment is a more wall-like feature, and as its strata roll away southward in shallow flexures, the Chalk outcrop is maintained over a very extensive area. In the northern cuesta the dip steepens from the coast toward Guines, and thence resumes and maintains a gentle angle as it curves round into the direction of pitch. It is disturbed by three nearly aligned periclines at Onglevert, Alembon

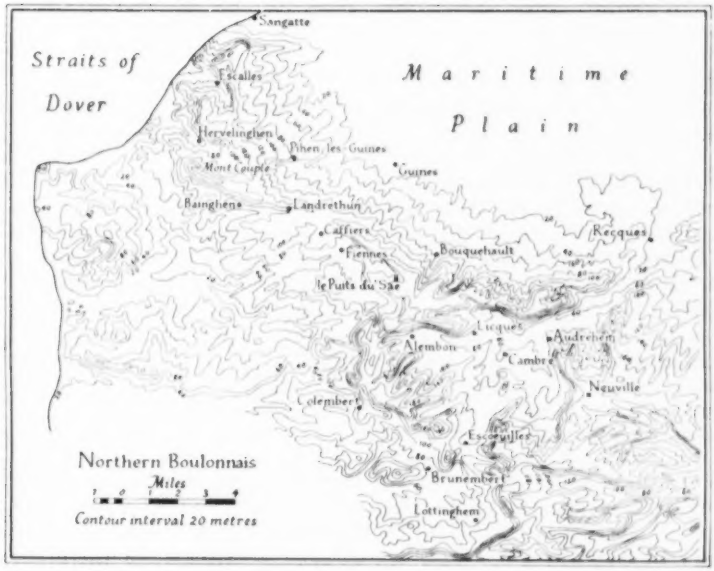


Figure 2

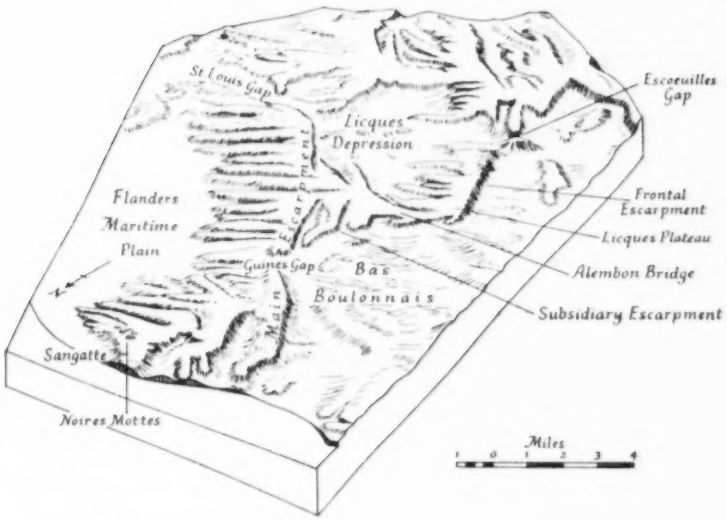


Figure 3.

and Licques, two small transverse anticlines near the coast, and an oblique anticline near Pihen-les-Guines (Fig. 7).

Topographic expression of the structure

For convenience of description the northern cuesta will be treated in three sections, divided by the gaps at Guines and Audrehem respectively.

(*a*) *The coastal sector*

The pronounced steepening of the dip towards Guines results in a progressive eastward change of dip-slope gradient, and of cuesta height and dimensions. The outcrop tapers rapidly inland in a blunt triangle. Where it should be broadest, at the coast, it has been reduced by short strike valleys at Escalles and Hervelinghen, and also by Pleistocene marine incision into the dip-slope near Sangatte, where a high degraded cliff locally produces a scarp-like appearance. The maximum width of the ridge and also its culminating height (533 feet) both occur inland of this dissection, at Mont Couple. Neither the Onglevert axis nor the fault which brings up the Carboniferous along the scarp foot has any serious effect upon the shape of the Chalk outcrop.

The cuesta is bevelled at the coastal end and forms a plinth for three steep conical knolls known as the Noires Mottes. The bright red Diestian sand of which they are composed is the largest remnant in the area of formerly widespread Lower Pliocene deposits: residual slabs of Pliocene ironstone still litter the crest as far east as Bainghen. The dip-slope is scored by sub-parallel dry valleys, locally integrated into thin bunches, especially near the Guines wind gap where they have been gathered up by the oblique anticlinal valley of Pihen-les-Guines.

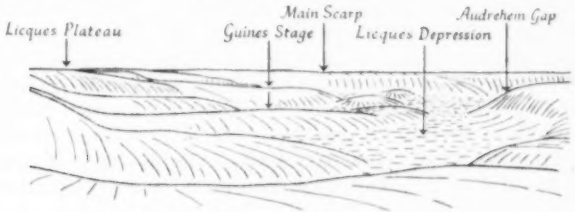
(*b*) *The Licques sector*

The Licques sector is wider than the coastal sector, chiefly on account of Middle Chalk ridges lying up to 5½ miles in front of the main escarpment. This sector is best described as a region of multiple scarps. In outcrop pattern, in structure and morphology it is more complex than the coastal block. It can be divided into an upper and lower dip-slope. The latter, formed of Upper Chalk, is bounded by the *main* escarpment. South of this the outcrop widens abruptly in two right-angled bends. The first bend, at Fiennes, marks the incoming of the *subsidiary* "escarpment" of Middle Chalk, which is separated from the main scarp by two aligned strike valleys. The second corner is several miles to the south-east at Colembert. This introduces a strong *frontal* escarpment of Middle and Lower Chalk, which extends as far east as the apex of the Bas Boulonnais.

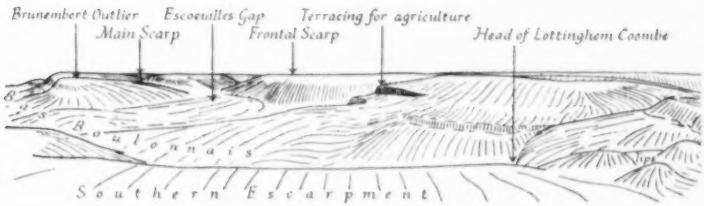
The most southerly of these three south-facing escarpments is related to the main Boulonnais anticline, and the two northerly ones to the periclines. The interposed syncline can only be very slight.

The Alembon pericline has acted as a watershed between the Slack and St. Louis basins which are in greatly contrasted stages of dissection. In the west the Slack has largely removed the Chalk from in front of the subsidiary escarpment, and there is no trace of a frontal block. The eastern half, however, forms a most interesting rectangle, comprising the Licques depression to the

north and a plateau to the south. The depression (Fig. 4a) is an almost completely enclosed basin, 300 feet below its girdle of hills. It is roughly coincident with the Licques pericline: consequently it is an example of inverted relief. It is drained by the St. Louis, and broadens eastward where right bank tributaries of this stream have cut down to the Gault or even the Bathonian, and opened out their valleys to form an integral part of the depression. Around Licques itself the feature is a flat-floored pocket approximately $2^1/_2$ miles across, and diversified by a few low hillocks. The drainage outlet at the north-east corner is a straight-sided gap which traverses the dip-slope obliquely. Unimpeded by interlocking spurs, it affords a clear view through to the Tertiary hill country 5 miles away at the dip foot. The St. Louis has consistently undercut its left bank both in the gap and in the depression.



a. The Licques Depression from the south-east



b. Looking north-westward from Lottinghem Coombe

Fig. 4. Field Sketches

The plateau south of the depression coincides in position with a shallow syncline. It consists of bevelled spurs of Middle Chalk between deep parallel valleys which trench directly across the fold. The frontal scarp is virtually unbreached where the valleys are dry, but deeper cols appear to the east. The largest gap is at Escoeuilles where a forked valley head encloses the Brunembert outlier. It is clear that the eastward broadening of the depression has been at the expense of the plateau which narrows in the same direction.

The western boundary of both plateau and depression is the Slack–St. Louis watershed. This straight ridge is at first similar to the other bevelled spurs of the plateau, but unlike them does not descend towards the depression, and instead continues as a high narrow bridge linking the frontal to the subsidiary, and then the main escarpments. To this feature the name Alembon Bridge is here given. It forms a spine from which the escarpments and intervening vales branch out perpendicularly. Crossing the main

escarpment the bridge feature is lost, but its line is continued down the lower dip-slope by the Bouquehault Valley, which is longer, deeper, and more sharply cut than any other member of its sub-parallel family.

Among the English chalklands the closest counterpart of the Licques block is that sector of the Kentish Downs between the Great Stour and the sea. The structure is somewhat similar, though in Kent the periclines are represented by a slight southward flattening of the dip which has the same effect of preserving an upper dip-slope of Middle Chalk. The physiographic contrasts of the upper and lower dip-slopes were described by Whitaker as long ago as 1875, and later shown by S. W. Wooldridge (1927) to be due to the respective sub-Pliocene and sub-Eocene origins of the two facets. A similar genetic explanation is here claimed to be applicable in the Boulonnais also. The upper dip-slope, or Licques plateau, is certainly bevelled, and reasons for supposing the bevel to be of Lower Pliocene age will be discussed later. The lower dip-slope has long been shown by Briquet to approximate to a stripped sub-Eocene basement (1908, 1910). The Kentish sector is far less dissected than the French, and this may appear anomalous in view of its greater proximity to base level, but it must be remembered that prior to the final opening of the Straits of Dover, some six to seven thousand years B.C., and the formation of the Flanders maritime plain, Kent did not in fact possess any such advantage.

(*c*) *The region of the unbreached anticline*

Though the Upper Chalk has been removed for some distance east of the Licques sector, the entire Chalk cover has not yet been breached. The valleys are deep but little widened, and hence the region has a massive, plateau-like aspect. The most arresting feature is the steep angular coombe at Lottinghem where the northern and southern scarps converge. This bears a close resemblance to the western end of the Weald at Petersfield, with one notable difference. There is no valley running through the French apex: one can stand above the very angle of the coombe and command a fine view of the treeless, hedgeless, arable plateau above, the terraced slopes, and the bocage country below (Fig. 4b).

Behind the coombe, dry valleys run in harmony with the pitch. A high proportion of them are asymmetrical in section, and show a close relationship with the main Boulonnais anticline.

Denudation stages

Although each of the three sectors possesses individual features related to its structure, they have all been exposed to the same regional influences during the period of their morphological evolution. It is now proposed to consider those characters which they have in common as a result of their mutual denudation chronology. To this end erosion surfaces have been studied in the field, and in order to provide a frame of reference for these field observations, there will first be presented a critical summary of investigations already carried out in the area and its wider region, the Paris Basin, the English Plain and the margins of the North Sea.

(a) Earlier work in the English Plain and North Sea margins

Our interest in the Boulonnais sprang originally from detailed work in East Kent and acquaintance with South-east England as a whole. Here the agreement between various workers is sufficiently great for general acceptance of the eustatic hypothesis. The facts are most concisely shown in a correlation table (Fig. 5), and additional comment is needed only upon certain features which have a bearing on the Boulonnais evidence.

In the first place a Mid-Tertiary subaerial peneplain at 1000–700 feet (Wooldridge and Linton, 1939) has been traced in gentle descent from the Cotswolds to the Medway, and since it pre-dates the certain existence of the Straits, might reasonably be sought in the Boulonnais. Secondly, this peneplain is broadly notched by the Pliocene Platform at 650–550 feet or rather lower in East Kent (Wooldridge and Linton, 1939). A degraded cliff-line and Lower Pliocene (Diestian) deposits testify to the marine origin of this surface. Most of the deposits have been removed by subaerial action, so that the platform itself is clearly an exhumed basal abrasion plane. This fact must be stressed, since both English and French workers have correlated this surface with the 180-metre platform in France, even though an incompatible age and relation to Diestian deposits is claimed for the latter.

At lower levels, platforms and terraces occur at close intervals, and it is reasonable to suppose that the Boulonnais may have experienced similar stages. We should not necessarily expect all the minor surfaces to be preserved, but we should certainly look for representatives of the large 400-foot and 200-foot platforms and the well-developed Boyn Hill, Taplow and Flood Plain terraces. It is also logical to draw pointers from two areas not far distant from the Boulonnais, the South Downs (B. W. Sparks, 1949) and the Blean of East Kent (A. Coleman, 1952).

Consistent agreement between the numerous erosion stages of the South Downs and the Blean is easily obtained if it is conceded, as other evidence indicates, that the Blean has been subject to slight secular depression. Such depression is related to the subsidence of the North Sea Geosyncline, the margins of which yield abundant evidence of Pliocene and Quaternary warping (*cf.* F. W. Harmer, 1896; T. Longfield, 1932; G. Stevens, 1945, 1947). The Boulonnais, also, borders the geosynclinal tract, and if it should prove to lie within the field of tectonic influence its eustatic record may well be obscured.

(b) Earlier work in the Paris Basin

Considerable work has been done in the Paris Basin, but much diversity of opinion still exists. The conclusions of various authors have been set out in the table, and three have been selected for further comment. E. de Martonne's views merit discussion because he attempted an overall survey as recently as 1947; H. Baulig's because he has thoroughly explored the eustatic hypothesis (1928, 1935); and A. Briquet's because of his detailed local work in the Nord.

De Martonne classifies the denudation stages of the Paris Basin as a Palaeogene surface, several Neogene surfaces, and four Quaternary river terraces as demonstrated in the Seine Valley by Chaput (1927).

The Palaeogene surface is clearly equivalent to the sub-Eocene surface of

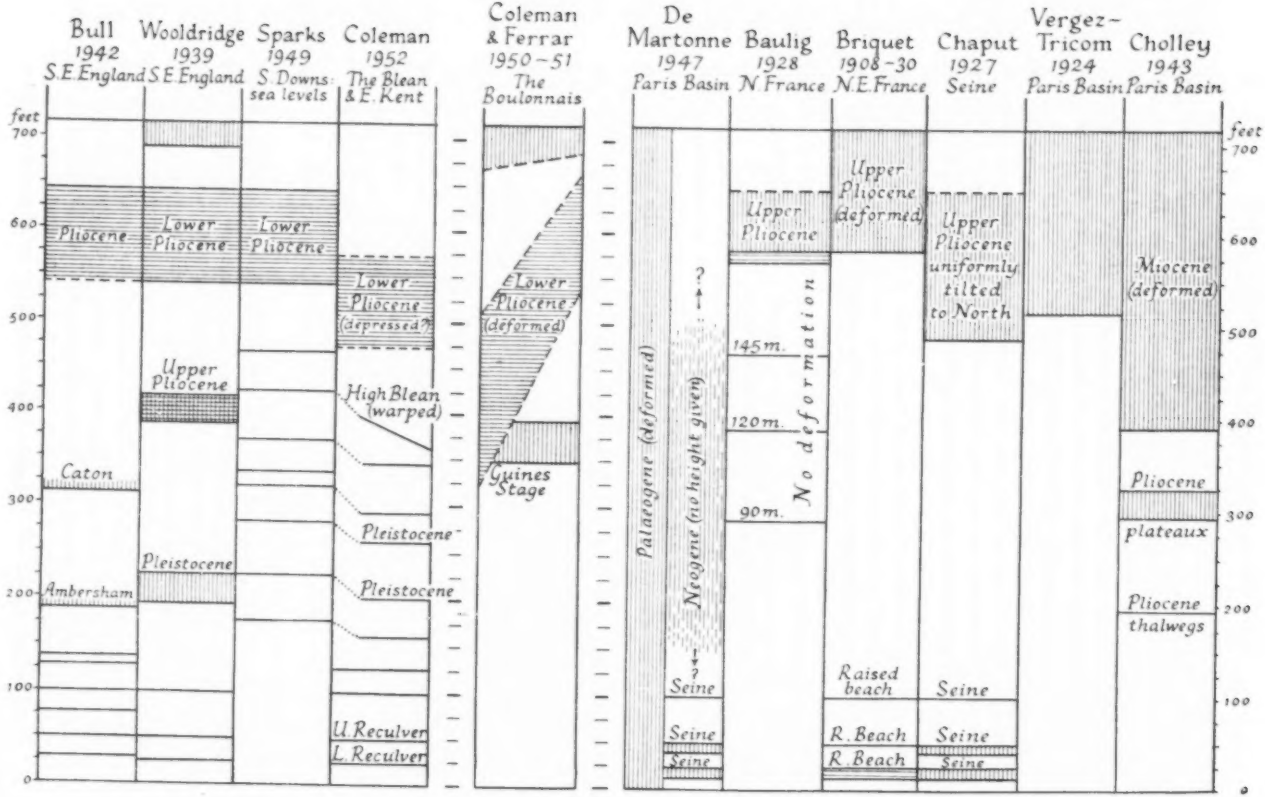

Bull
1942
S.E. England
Wooldridge
1939
S.E. England
Sparks
1949
S. Downs: sea levels
Coleman
1952
The Blean & E. Kent
Coleman & Ferrar
1950–51
The Boulonnais
De Martonne
1947
Paris Basin
Baulig
1928
N. France
Briquet
1908–30
N.E. France
Chaput
1927
Seine
Vergez-Tricom
1924
Paris Basin
Cholley
1943
Paris Basin
feet
700
600
500
400
300
200
100
0
Pliocene
Lower Pliocene
Lower Pliocene (depressed?)
Upper Pliocene
High Blean (warped)
Caton
Pleistocene
Ambersham
Pleistocene
Pleistocene
U. Reculver
L. Reculver
Lower Pliocene (deformed)
Guines Stage
Palaeogene (deformed)
Neogene (no height given)
?
?
Seine
Seine
Seine
Upper Pliocene
Upper Pliocene (deformed)
145 m.
120 m.
90 m.
No deformation
Raised beach
R. Beach
R. Beach
Upper Pliocene uniformly tilted to North
Seine
Seine
Seine
Miocene (deformed)
Pliocene
plateaux
Pliocene
thalwegs

Figure 5

the English Plain. Its form in the Boulonnais has been carefully studied by Briquet. It constitutes the lower dip-slope of the northern cuesta, rounds the pitch slope, and spreads extensively over the southern flank. Towards the crests it has been bevelled away.

The Neogene surfaces present more difficulty, and de Martonne shows a worthy caution in adhering to evidence dated by deposits. He refers to Aufrere's mention of a stripped sub-Falunian (Miocene) surface in Berry, and claims that the Noires Mottes are also Falunian instead of Diestian as hitherto believed. This claim appears to pave the way for correlating the sub-Diestian bevel of the western Boulonnais with the Neogene surface of Berry, but rather surprisingly de Martonne ignores the bevel, and instead correlates "crests which are intermediate in height between the edge of the Chalk margin and the bottom of the 'fosse'." The other Neogene surfaces are not correlated with any in the Boulonnais, and in the absence of altitudinal data cannot be discussed.

It is regretted that de Martonne does not regard height information as a strengthening complement to the evidence of deposits: inevitably his analysis has been impoverished. He pays little attention to Briquet's Pliocene peneplain and actively rejects Baulig's eustatic hypothesis on grounds of the absence of deposits. But in the opinion of the present writers both these workers have made valuable contributions.

In 1928 Baulig presented a lucid account of his altimetric frequency survey of Northern France, from Brittany to Lorraine, and claimed the existence of undeformed erosion surfaces at certain absolutely constant heights irrespective of locality and structure. The best developed lie at 180, 280 and 380 metres; lesser features occur at 250, 145, 120 and 90 metres, and at two lower elevations not specified. Equivalent values in feet are given in the table.

Baulig believes that the surfaces are mainly subaerial; the figures cited are the lower limits, and represent probable old base levels. During the three chief stages the sea must have occupied at least the centre of the Paris Basin, and the absence of marine deposits is explained partly by analogy with the present Channel floor where there is little accumulation, and partly by invoking later erosion.

Baulig dates the main surfaces as Upper Pliocene on the grounds that they remain horizontal even where the Lower Pliocene is deformed, as in the Boulonnais, and he believes that a similar truncation of the Diestian Beds by the 180-metre surface has occurred in Kent. In both these points he follows Briquet.

Briquet's work is scattered in numerous publications over a period of thirty years. His detailed correlation of stillstands below 35 metres is in excellent agreement both with Chaput's work on the Seine terraces and also with English findings. He also demonstrated the presence of a major erosion surface at 180 metres, a part of which bevels the Boulonnais rim. He regarded this surface as subaerial, on account of thin gravelly and sandy deposits ("sédiments pauvres"); and because these deposits cap deformed Middle and Lower Pliocene Beds in Holland and Germany, as well as the local Diestian, he dated the peneplain as Upper Pliocene. Unlike Baulig he does not believe it has been entirely exempt from later warping.

The fundamental cleavage in English and French views on this surface can now be stated. A French Upper Pliocene subaerial peneplain grading down to a 590-foot sea-level is directly equated with an English Lower Pliocene marine platform below a 650-foot cliff-line. This is manifestly an impossible correlation, and logically there are three alternative solutions.

(i) The English Pliocene Platform is, as the French workers claim, a subaerial surface truncating the Diestian deposits.
(ii) The French 180-metre surface is, as the English assume, a sub-Pliocene marine feature.
(iii) The two surfaces are falsely correlated.

The correct solution must be sought in the field observations.

(*c*) *Technique and equipment used in the morphological survey*

The area has been explored on foot, and flat surfaces mapped on a 2½-inch scale. Their heights were established by aneroid survey, one aneroid being read at frequent intervals at a base station, while another was being carried in the field. In the time available (two visits during successive summer vacations, 1949 and 1950) an exhaustive survey of all the erosion surfaces was not possible, and it was considered most profitable to map the scarp crests completely, and restrict examination of the dip-slopes to sample spurs. In this way 137 "flats" have been mapped, and the heights of 110 determined.

In assessing the accuracy of these measurements it is necessary to comment upon the maps and the aneroid method employed. The former were G.S.G.S. 2½-inch maps kindly loaned by the War Office, although considered too poor for general issue. They were compiled from air photographs on a control provided by existing French triangulation. In most respects they proved satisfactory, but the contours, at 10-metre intervals, are not always reliable, and trigonometrical stations or spot heights are the only height information of guaranteed accuracy. Such points are extremely sparse as compared with English maps: a 1:25,000 sheet, which represents 60 square miles does not normally carry more than three or four of them and even of these a certain proportion are not identifiable in the field. The survey had to be based primarily on three of these points only, while a few additional stations were established by aneroid measurement. For these latter, the margin of error, which is normally 5 feet in aneroid survey, must be considered doubled, though in practice checks made at previously measured points revealed a discrepancy of more than 4 feet in one case only.

In view of the inadequacies of the base map, it is not surprising to find that French workers have not undertaken detailed morphological mapping to the degree of accuracy attempted in this survey. We are confident, therefore, that though the heights are somewhat less precise than similar measurements made in England, they represent a distinct advance in our knowledge of the Boulonnais.

In the absence of any large error, it must be admitted that the surfaces remain difficult to interpret. Although they occur at almost every height between the sea and the summits, there are few marked planations at consistent levels, and certainly no record comparable with that of the Blean only

35 miles away. Three stages can be tentatively recognized. One is the local summit plane at 700 feet; a second is separated by virtue of its Pliocene outliers; and the third is a little more distinct on account of its more recent origin, a little below 400 feet. Thus, a whole series of stages which are present in Kent and Sussex are apparently unrepresented in the Boulonnais.

(d) The Guines stage

There are numerous remains of an erosion surface between 350 and 400 feet, some of which are shown in Figure 6. This is termed the Guines stage since it has been most fully mapped in the Guines Gap. It is also well

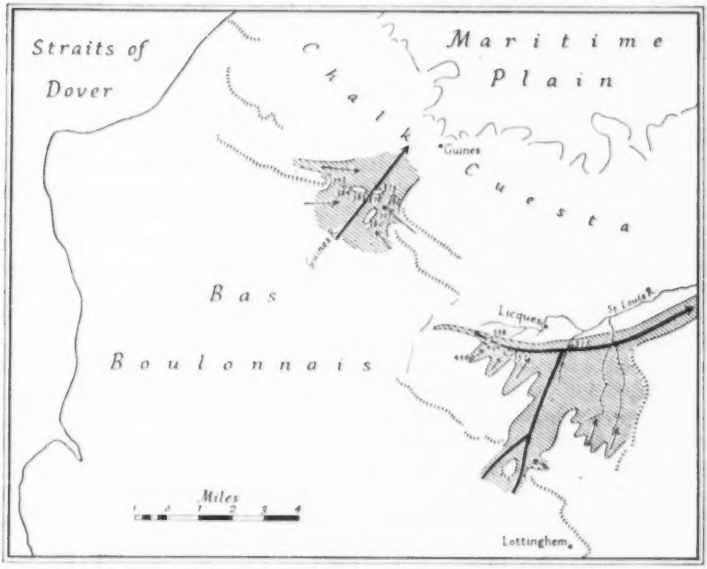


Fig. 6. Reconstruction of Guines and St. Louis Valleys at the Guines stage

developed in the St. Louis Gap and the Licques Depression. Thus its plan and relation to existing valleys strongly suggest that it is of fluviatile origin, though no corroborative drift has yet been found.

The floor of the Guines Gap is 2 miles wide between 370 and 400 feet. Grading down to it from the south near Caffiers, is another flat half a mile long. These facts suggest that a large northward-flowing river occupied the gap during the Guines stage, but abandoned it towards the end. Tributaries are also indicated, especially that of Pihen-les-Guines where the Guines stage floor has been dissected into valley-side benches.

Uniclinal shifting of the St. Louis in the Licques Depression has produced a fine set of benches between 350 and 400 feet on the southern side. They were broadest at the eastern end where they have since been dissected into

knolls, such as Cambre, 377 feet. Similar benches were observed, though not mapped, on the right side of the Tournehem gap, and there is little doubt that these represent the Guines stage outlet from the depression. Upstream, the Escoeuilles wind gaps must also have been occupied at this stage.

The drainage reconstruction for this period shows that the longitudinal reaches of streams were then south, or in general up-dip, of their present lines, and transverse trunk streams headed inside the Boulonnais and traversed the Chalk cuesta as the Wealden rivers continue to do.

(*e*) *The Pliocene Platform*

The next recognizable surface above the Guines stage is the one represented here as a sub-Pliocene marine abrasion surface. Three lines of evidence supporting this belief will be examined, namely, the Diestian deposits, the distinctive drainage pattern believed to be superimposed from them, and the actual morphology of the surface itself.

Deposits are, of course, the primary evidence. The best exposures are in the Noires Mottes where the character of the Diestian Beds [1] can be well seen. The bulk of the material is a coarse, bright red sand containing blocks of ironstone. Residual pieces of this ironstone occur along the scarp crest as far as Bainghen, but are absent in the neighbourhood of the Guines Gap. An outlier at Rameceau on the Alembon bridge was described by J. Gosselet in 1910, and the present writers were able to examine a fresh section at about 160 metres near les Puits du Sae, which had apparently been opened for sandbags during the war. Here there was bright red current-bedded sand without ironstone beneath 5–6 feet of limon. A further outlier, previously unrecorded, was also observed in a trench at 612 feet on the scarp crest near Neuville, and its extent of at least several hundred yards was indicated by the rosy tinge that suffused the adjoining ploughland. A similar coloration has been noted in newly broken land on Pliocene Beds at Folkestone, but it is not detectable on ground that has been long cultivated.

These various outliers testify to the former continuity of the Diestian Beds from the coast at least as far inland as Neuville. It is not clear from these alone, however, what was their original breadth or southern limit.

Some illumination upon this latter point is shed by the distribution of inconsequent drainage lines, which are also corroborative evidence that a marine transgression did in fact occur. As early as 1904 J. Cornet demonstrated the superimposed character of the Aa and St. Louis. It is now patent that the minor valleys also, including dry valleys, cross the Licques Plateau

[1] In ascribing Diestian age to these deposits we follow several writers, *e.g.* Wooldridge, Gosselet, Briquet and Baulig, but are at variance with certain others who suggest rather earlier or later dating. Should these latter prove right, another term would have to be substituted for Diestian, but except in the unlikely event of the deposits of Kent and the Boulonnais proving non-contemporaneous, the morphological argument advanced here would remain unaffected. The deposits on the two sides of the Straits are strikingly similar. Though the distinctive heavy mineral suite used to date the Lower Pliocene of Surrey, etc., could not be recognized in the French samples studied, this in no way undermines the correlation, merely indicating a different petrographic source for the more easterly part of the Diestian. The fact that the suite has already begun to fail in the Folkestone area is a cogent link between the English and French outliers.

syncline in complete disregard of structure. The simplest explanation of this, and one fully in accord with the evidence of the deposits, is superimposition from a marine cover, and so we may deduce that the Diestian Sea covered the major part of the Licques sector except part of the crest of the frontal escarpment which is not traversed by valleys, and which may have remained as a subaerial island.

The third line of evidence is provided by the platform itself and its morphological relationship with the deposits. This is best seen at the Noires Mottes where the Diestian Beds surmount the platform and show that it is basal to them. Elsewhere the deposits have been stripped away entirely and the surface extends without interruption on the Chalk. A slight doubt is cast in the vicinity of the Rameceau and Neuville outliers where the surface appears to be developed in the Diestian Beds themselves, but the writers conclude that here thin relict skins of sand are reproducing the contour of the basal platform which lies at only a very shallow depth. Thus the field evidence points to a Diestian age for the platform.

The platform has been cut in Upper and Middle Chalk alike, and was clearly once continued over the Eocene Beds that lay to the north. These have since been denuded to expose the sub-Eocene dip-slope, which now intersects and bounds the Diestian surface. The present extent of the surface varies with the width of the Chalk outcrop. It forms the broad triangular bevel near the coast, dwindles to extinction near the Guines Gap, and broadens in the Licques sector where it occupies the main and subsidiary crests, and the major part of the Licques Plateau. Part of the frontal rim probably rises above it, though this exception is not so clear on morphological as on other grounds.

In the field the platform appears broad and spacious, but in fact large parts of it have been slightly reduced and so do not figure on the map. Those sensibly flat portions which have been mapped do not really give a sufficient impression of its extent, but they have the compensating advantage of yielding accurate height data.

An attempt has been made to contour the platform at 10-foot intervals. Its most general feature is a northerly descent which seems too marked to be purely the original seaward gradient. Both this and several other features of the contour pattern suggest that the platform has been warped. The marked depression near the Noires Mottes has long been cited in evidence of post-Diestian tectonic deformation, while the lesser undulations show an unusual but quite coherent trend in harmony with the fold axes. The contours loop north at one of the transverse anticlines, and rise towards the Mont Couple pericline. There is also an inward rise to the Alembon pericline along both main and subsidiary escarpments, and east of Escoeuilles the surface remains high all round the end of the main Boulonnais arch.

So consistent a correspondence between the form of the surface and the pattern of Tertiary movements is difficult, if not impossible, to explain without invoking a slight post-Diestian recrudescence of activity along the Tertiary axes. It has been noted earlier that such activity is fully expectable on the North Sea margin: it has long been recognized near the Noires Mottes. Moreover, Briquet claimed that there is also a measurable distortion of the

Pliocene peneplain in the eastern Boulonnais. There is thus nothing inherently improbable in the hypothesis: it will receive further attention after a description of the 200-metre (660 feet) subaerial surface.

(*f*) *The 200-metre subaerial surface*

It is believed that the marine surface can be distinguished from a slightly higher surface, at 660–720 feet which occupies the eastern rim of the Boulonnais in an area shaped like a boomerang. Its rounded shallow undulations appear subtly different from the flatter Pliocene platform, and though it is evidently an erosion feature, it is impossible to find any flat fragments sufficiently well preserved to map. This is just the area which, as has already been suggested, probably formed a low island in the shallow Diestian Sea. At least the final phase of its development was contemporaneous with, and related to the same base level as the marine abrasion surface. No conspicuous cliffs would have been developed, and the precise boundary of the island is consequently a little difficult to establish. But there is no doubt of its existence.

(*g*) *Interpretation and correlation of the surfaces*

The stages worked out above represent the writers' conclusions drawn from the field evidence, but they do not wholly conform with the views of earlier workers, and so the present interpretation must be examined in a broader context.

An upper subaerially-formed crest (see Fig. 7), closely succeeded by a broad marine platform, exactly parallels the earliest part of the sequence worked out in South-east England. It also conforms to Baulig's general thesis that the 180-metre (590 feet) surface is probably in part subaerial and in part marine. But it conflicts with Briquet's claim of a unitary subaerial surface occupying the height range of both facets, and of Upper Pliocene age. The evidence cited in favour of a wholly subaerial origin is the existence on both Chalk and Pliocene Beds of certain gravelly "sédiments pauvres." Because these "sédiments pauvres" are found on top of the Noires Mottes, Briquet did not believe that the surface passed beneath the Noires Mottes, but that it truncated their top, and this explains his Upper Pliocene dating.

In attempting to solve this problem it is first relevant to note that the "sédiments pauvres" include certain red sands as well as gravels, and in a few cases consist of red sand alone. These have not been observed in the field by the present writers, but it seems possible that they may have been simply Diestian relics testifying not to a subaerial but to a marine origin for at least a part of the peneplane. In any case, however correct Briquet's interpretation may have been, the existence of "sédiments pauvres" can in no way invalidate the evidence for a sub-Diestian abrasion plane beneath the Noires Mottes, and we believe that it is this, and not the plane cutting the top of these hillocks, which extends over much of the northern Boulonnais.

This view is supported by conditions on the English North Downs, where Briquet mentions the local occurrence of a drift precisely similar to the "sédiments pauvres." Here it has never been used to contravert the marine origin of the Pliocene Platform, and appears to be merely a landwash which

found its way over the Diestian deposits after the retreat of the Diestian Sea. If such an argument is valid in England, it is certainly not necessary in France to accept this drift in proof of the subaerial nature of a surface which on other grounds appears partly marine.

In thus separating a part of Briquet's Pliocene Peneplain as a different surface, the problem is not entirely solved, for we cannot equate the 200-metre subaerial surface, which is pre-Pliocene in age, with an Upper Pliocene feature. We would suggest that the "sédiments pauvres" on top of the Noires Mottes and other Lower Pliocene deposits are similar in character to those of the pre-Pliocene peneplain because they were derived from them, rather than

Blanc Nez anticline
Straits of Dover
Maritime Plain
Desvres anticline
Alembon periclines
Licques periclines
Main Boulonnais anticline
Miles
0 1 2 3 4
Escarpments or the steeper sides of asymmetrical valleys
'Flats' believed to be part of a Pliocene marine platform
Reconstructed contours of the Pliocene platform (Spot heights shown in feet)
Area believed part of an island in the Pliocene sea
Anticlinal or periclinal axes

Fig. 7. Physiography of the Boulonnais

because they were contemporaneous. By this argument, the stages of development [1] of the terrain are, firstly a peneplain which was largely submerged and wave-trimmed at a second, Diestian, stage, and thirdly a subaerial redistribution of "sédiments pauvres" from the peneplain over the marine deposits upon the retreat of the Pliocene Sea.

It has already been noted that Briquet claimed post-Diestian doming in the eastern Boulonnais. This was inferred from a map showing the 150-metre and 200-metre generalized contours on the peneplain. But the coincidence

[1] This sequence both fits the field evidence drawn from the Boulonnais and also permits a satisfactory correlation with English stages. But it should be noted that for the wider area of the Paris Basin the conflicting views analysed on page 67 remain unresolved.

of the dome with part of an old watershed precludes proof that the rise is anything more than a normal piece of land sculpture. Nor is the claim improved if made in the context of the two surfaces demonstrated here: the dome then coincides with the subaerial island, and warping is again an unnecessary hypothesis.

Nevertheless, the present writers believe that Briquet's judgement was right even if his evidence was inadequate, and the more detailed contouring which has now been made possible supports his claim. No contours have been drawn on the subaerial surface: they are restricted to the marine plane. The dome still appears, and in addition the minor structural axes are shown to have shared in the warping as well.

Deformation cannot be due to absolute uplift, since both upper and lower limits of the marine shelf lie lower than their counterparts in stable areas of England. It is concluded that the domes result from differential resistance in anticlinal tracts to the general subsidence of the area as a whole. The amplitude of the movement has not been enough to destroy the sensible flatness of individual flats, but it has destroyed their unity of level over any considerable area.

Warping of the Pliocene Platform must also have affected the 200-metre (660–720 feet) surface, and this provides a satisfactory explanation of the absence of a level line of junction between the two. Whether the movements continued sufficiently late in time to affect the Guines surface also is more difficult to ascertain. It is probable that they continued later near the coast, where the platform descends below the Guines stage level, than farther inland where a substantial bluff separates the two. Thus two and possibly three of the surfaces should be correlated with slightly higher stages in England. The relations of the two upper features are not in doubt, but that of the Guines stage is complicated by our lack of knowledge on where the rivers of the period met the sea. On general grounds one would expect the only recognizable post-Diestian surface in the Boulonnais to correspond with the best developed post-Diestian surface in the London Basin, namely the 400-foot platform, and as this latter is, in fact, just a little higher than the Guines stage, it would certainly fill the role well.

In addition to this reasonable altitudinal fit at the upper levels, the terrace and raised beach features examined by Chaput and Briquet respectively correlate well with each other and also with the major phases of stillstand adduced in England. The main gaps therefore are in the middle of the sequence. Three reasons can be advanced to explain such gaps. Firstly, the hypothecated warping may have deformed certain minor stages beyond recognition. Secondly, other minor stages may actually be present, but not yet mapped in sufficient numbers to form well-marked aggregates when graphed. And finally, it may be that many of the surfaces were originally cut in Eocene Beds, and have subsequently been destroyed.

Drainage evolution

The solid landforms and two of the three erosion surfaces have been the work of rivers acting in conjunction with changing base level. Accordingly it is instructive to examine the pattern of the rivers and dry valleys of the area.

Such an approach often yields conclusions which are complementary to those drawn from the surfaces themselves.

The most noticeable characteristic is the lithological control imposed upon drainage density. Alike in Weald and Boulonnais a dense interior network is surrounded by a Chalk zone of rare and branchless trunk streams. The second characteristic, on the contrary, differs of the two sides of the Straits. While the radial Wealden streams cross the Chalk in major gaps, the Boulonnais rim is everywhere a watershed, inside which centripetal streams seek the sea between Gris Nez and Neufchatel. Formerly the Boulonnais possessed radial drainage akin to that of the Weald. The reversal of direction must be accounted for. A further problem is posed by diversity in valley form and plan. In general the upper dip-slope is deeply dissected by a somewhat integrated valley net, while the lower dip-slope is furrowed by shallow parallel valleys. The latter set of drainage lines superficially resembles a down-dip extension of the former, but except in the unbreached sector, local discontinuities show that they must have originated independently. There were, it appears, two main formative phases in stream development, separated by the period of reversal mentioned above.

The best approach to these problems is the genetic one. An attempt will be made to outline the evolution of the rivers and of the area in general.

The first stage of which there is clear evidence was not formative but residual. It was the time of the Pliocene transgression. The sea passed south of the present scarp in the coastal sector, as in Kent also, but it is not known whether it extended sufficiently far to flood the Straits or to occupy the central Boulonnais. The subaerial "island" mentioned earlier may actually have been joined to a central Boulonnais ridge, but in any case certain of its characteristics can be deduced from the available evidence. It was low and graded gently to the sea: no marked cliffs can now be discerned. It acted as a watershed, and has maintained this role ever since. The one through valley (the Escoeuilles gap) was probably a gulf or strait representing a drowned pre-existing river.

The second stage was the retreat of the Pliocene Sea and the exposure of the offshore platform covered with thin sands. Across this surface spread the first set of rivers, flowing in the general direction of dip and pitch, but in detail crossing the minor structures of the underlying Chalk transversely. As the sands were gradually stripped off, the rivers were superimposed directly upon the Chalk. Their disregard of the Licques Plateau syncline, and the Licques pericline has already been cited as contributory evidence of the marine nature of the Pliocene Platform. Such independence of structure could hardly occur in a drainage system inherited intact from a subaerial surface. It is in marked contrast with the better adapted drainage lines south of the Boulonnais which are apparently of much more ancient origin.

The position and height of the coastline after the retreat of the Pliocene sea are not known. It was probably cut in Eocene Beds, which have since been removed. Eventually, if not immediately, the sea established itself at the Guines stage level and controlled the depth of ensuing dissection. The streams now crossed as many as four geological bands which intersected the marine plane, and therefore different parts of their valleys were opened out

at varying rates. The head reaches flowed on Jurassic and Lower Cretaceous Beds where a prevailing impermeability assisted maximum denudation. Downstream the Lower and Middle Chalk were more permeable but not sufficiently so as to dessicate the valleys or to prevent integration of the drainage by developing subsequents, which appeared in the main at the junction between the Middle Chalk and the more permeable and resistant Upper Chalk, which formed the third environment. Little can be known of the fourth band, which was the former Eocene tract. In the vicinity of the subaerial island the valleys headed not upon Jurassic but upon Chalk. By the end of the Guines stage all the sources had arrived at a similar position. The Guines River no longer occupied its gap, and the twin heads of the St. Louis had been intercepted above the Escoeuilles Gap. The cause was clearly capture, effected respectively by the Slack and the Liane. The activity of these two pirates may well have been accelerated by the breaching of the southern flank of the Weald somewhere between Neufchatel and Beachy Head, and the resultant approach of base level to the Boulonnais. This episode certainly pre-dated the final formation of the Straits, and could feasibly have occurred before or during the Guines stage, as suggested, but this problem together with the whole question of the separation of Britain, requires a much closer acquaintance with the Bas Boulonnais.

Resulting from this reversal of drainage is an absence of gaps below 370 feet in the Boulonnais rim. The lack of a Holmesdale feature, which is primarily because the Lower Greensand is too thin to be a ridge former, is also influenced by the inward direction of streams. In England the rivers are well developed where they cross the Gault, and are fed by substantial tributaries which have etched out the Vale. In France the streams originate in springs only just above the clay. They are too closely spaced to possess any large strike affluents, and the Gault remains high in relation to the Lower Greensand.

A third stage in the drainage development was the post-Guines retreat of the sea, and the initiation of a second sub-parallel family of streams, this time upon newly exposed Eocene Beds. These streams cut down to the Chalk, and then soon dried away, leaving only the shallow grooves which so strongly distinguish the sub-Eocene dip-slope from the Pliocene Platform. In some cases these valleys could be the beheaded continuations of post-Pliocene rivers formed before the longitudinal subsequents had set in, but elsewhere it is perfectly obvious that there is no alignment between the two systems. A clear example occurs at the Guines gap, where there is no trace of a continuation of the beheaded Guines River, and instead three or four typical lower dip-slope valleys begin on the lip of the gap, in blunt unconformity with the Guines stage morphology. This can only be explained by assuming that the sea remained close to the gap until after the latter had been abandoned, and then retreated to allow the initiation of a completely new drainage on the Eocene outcrop. In the case of the St. Louis, however, the river was not so drastically beheaded, and continuity was assured. Still farther round the pitch the land is largely above 400 feet and it appears that all the streams were able to extend and deepen their valleys without interruption by the sea.

After this stage, subsequent changes of base level had only minor effect

and in this was no doubt aided by the dessication of many valleys: the Chalk valley net has tended to become fossil at a post-Guines stage.

Conclusion

Three tasks have been attempted, firstly a description of the interestingly diversified structure and topography of the Northern Boulonnais, secondly an analysis of mapped erosion surfaces which are largely independent of structure and thirdly the outlining of drainage development. It is noted that the evolution of the drainage system was closely related to the formation of erosion surfaces, but the development of each of these features has been demonstrated on mutually independent grounds, thus providing a mutual check. Their interrelation proves to be coherent, and so, despite the sampling nature of the survey, we do not hesitate to present this denudation chronology based upon field observations.

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Discovery of Lake Ngami, 1 August 1849

From 'Missionary travels and researches in South Africa,' by David Livingstone (John Murray, 1857)

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING EXTRACT is taken from a paper compiled from letters written by Dr. David Livingstone during the year 1853, and read before the Society on 12 June 1854 (*Journal of the R.G.S.*, 24, 291). Livingstone was at the time pressing north from Kuruman into the African interior seeking healthy country for a mission station. The plate illustrates the discovery of Lake Ngami in 1849 when Livingstone was travelling with his family.

Town of Sekeletu, Linyani, 20th September, 1853.

"About the end of July we embarked on our journey to the N., embarking at Sekhose's village on the Zambese, or, as the aborigines universally name it, the Leeambye, viz., *the river*. This village is about 25 miles W. of the town of Sesheke. When I proposed to Sekeletu to examine his country and ascertain if there were any suitable locality for a mission, he consented frankly; but he had not yet seen me enough. Then he would not allow me to go alone; some evil might befal me, and he would be accountable. This and fever caused some delay, so that we did not get off till about the end of July. In the mean time I learned particulars of what had taken place here since my last visit in 1852.

The daughter of Sabituane had resigned the chieftainship into (Sekeletu's) her brother's hands. From all I can learn she did it gracefully and sincerely. Influential men advised her to put Sekeletu to death, lest he should become troublesome when he became older. She turned from their proposals in disgust, called a meeting, and, with a womanly gush of tears, said she had been induced to rule by her father, but her own inclination had always been to lead a domestic life. She therefore requested Sekeletu to take the chieftainship, and allow her to marry. . . .

I do not now wonder at the resolution of Sebituane's daughter, who had just come from a nine weeks' tour, in company with a crowd who would have been her courtiers: there was no want of food, oxen were slaughtered almost every day in numbers more than sufficient for the wants of all. They were all as kind and attentive to me as they could have been to her, yet to endure their dancing, roaring, and singing, their jesting, anecdotes, grumbling, quarrelling, murdering, and meanness, equalled a pretty stiff penance. These children of nature gave me a more intense disgust to heathenism, and a much higher opinion of the effects of missions among tribes in the S. which are reported to have been as savage as they, than I ever had before."

OPERATION EVEREST

THE ASCENT OF EVEREST. By JOHN HUNT. *Hodder & Stoughton.* $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 300 *pages;* 56 *photographs,* 8 *in colour, sketch-maps.* 25*s*

IN THIS BOOK Sir John Hunt tells the story of the successful Mount Everest Expedition of 1953. By the use of appendices for his more technical matter the author has achieved a clear and eminently readable narrative of a great enterprise while at the same time dealing fully with those more specialized questions which primarily concern mountaineers. The climax of the story is provided in a chapter by Sir Edmund Hillary on the final assault, in which he describes the great climb with his famous companion Tenzing. The book is profusely illustrated with photographs and a number of delightful pen-and-ink sketches, inset in the text, by Charles Evans. In the brief period of one month Sir John Hunt has produced an epic story and a standard work on the conduct of a great Himalayan expedition.

Sir John Hunt is a soldier of wide experience, practised in the command of troops in war under widely diverse conditions and trained in staff work on a high level in peace. Added to his great personal qualities and to his outstanding reputation as a mountaineer in two continents, these were the qualifications which fitted him so admirably for the leadership of an Everest expedition. He tells us himself that he appreciated his problem largely in terms of a military operation. Many aspects of this expedition were, in fact, of this nature. The importance of detailed planning: the necessity for perfecting supply and transport; the maintenance of health and *morale* among both climbers and porters; accurate timing and even the personal intervention of the leader in the "front line" at a critical stage—herein were his most notable contributions to success.

Good leadership alone however could not suffice. Happily a very strong party was available to implement that leadership. In addition to mountaineering standards of a high order, this year's party was conspicuous for its team spirit. Essential as this spirit must always be to the success of a big expedition, it was of particular importance in an assault on the south face of Mount Everest. This face presents a series of major difficulties throughout: the icefall which forms the gate to the Western Cwm, the formidable Lhotse face, and the final difficult 400 feet. These made demands on the climbers in excess of what was required on the north face of the mountain, dispersing the efforts of the whole team over a wide area.

In addition to leadership and team work another factor made a big contribution to the achievements of the 1953 expedition: the part played by the oxygen apparatus. Sir John Hunt based his plan on his confidence in oxygen and it is more than doubtful whether, without it, success would have been achieved. The difficulty of the last 400 feet alone might well have defied a non-oxygen attempt. It is also significant that, whether thanks to the use of oxygen or to the efficiency of the clothing and boots provided this year—but probably to both—there was not a single serious case of frost-bite. None the less there were some puzzling features connected with the use of oxygen. The exhaustion of parties descending from a high climb, and after it was over, seems to have been greater than in the earlier expeditions; nor did the aid of oxygen apparently improve the performance of the porters at extreme altitudes to the extent that might have been anticipated. In 1953 only three Sherpas were found fit and willing to go beyond the South Col at 26,000 feet, yet in 1933 eight of Ruttledge's porters

without oxygen carried loads to 27,400 feet and professed themselves willing to go even higher on the same day.

With this possible reservation the part played by the Sherpas was once more, as in the past, of supreme importance, and in a final chapter entitled "Reflections" Sir John Hunt gives an impressive summary of their performance. It must be realized that a cardinal point in the plan was the establishment of a really adequate and well-stocked camp on the South Col. The lesson of the Swiss expedition's difficulties in this respect had been duly learnt: it was there that the Sherpa porters made their most important contribution to ultimate success. The load-carrying performance by the climbers themselves was this year on a scale unprecedented in any previous British expedition to Mount Everest. Hunt himself, Gregory and Lowe all carried loads of from 50 to 63 lb. to heights of between 27,000 and 28,000 feet, and it was this remarkable performance which enabled the final camp to be established at nearly 28,000 feet.

Sir Edmund Hillary's chapter is naturally one of the high lights of the book. In it, for the first time, the veil is drawn and we learn the exact nature of the last difficult ridge. Until the South Summit was reached by Evans and Bourdillon no close view of the ridge had been possible, and their report emphasized rather than dispelled the anxiety about its feasibility which had been felt by mountaineers. It proved, in fact, a formidable climb by any standard and, had the condition of the snow on this ridge been less favourable or the finalist pair less determined and skilful, it might well have defied success at the eleventh hour. The description of the moment when the climbers suddenly realized that the summit had been reached, and the goal of so many ambitions attained, is told with restraint, but enough is said for the reader to guess something of what it must have meant to stand at last on the summit of the world.

E. F. NORTON

THE VOYAGE OF *L'HÉRÉTIQUE*

THE BOMBARD STORY. By ALAIN BOMBARD (translated by Brian Connell) *London: André Deutsch*, 1953. $5\frac{1}{2} \times 8\frac{1}{2}$ *inches; 214 pages; plates and diagrams.* 12*s* 6*d*

WHILE DR. ALAIN BOMBARD was working at the Boulogne hospital a trawler hit the outer end of the Carnot mole. The weather was cold, but there was a calm sea. Forty-three trawlermen were brought to the hospital ". . . piled one on top of the other, like dislocated puppets, their feet bare and each still wearing a life belt." Not one of these men could be revived.

At that time Dr. Bombard had been studying the resistance of human beings to privations and had concluded that the individuals could survive beyond the limits set by physiologists. The tragedy of the shipwreck gave direction to his studies. He found that between 100 and 150 Boulogne fishermen were lost each year while ". . . throughout the world in time of peace more than two hundred thousand men—and women—suffered the same fate. More than a quarter of them, having survived disaster and reached the boats, died afterwards in mortal agony." There were statistics showing that 90 per cent. of the survivors of shipwreck died within three days, but it takes longer than three days to die of hunger and thirst. What could be done to reduce this loss of life?

Later in the same year (1951) Bombard went sailing with a friend in a new type of rubber dinghy and had occasion to prove the seaworthiness of this type of lifeboat in a gale. This was encouraging. On his return Bombard discussed his theories of survival at sea with a man who became for a time his patron. As a result Bombard decided to go to the Museum of Oceanography at Monaco to begin a full-time study of the technique of survival in an open boat on an open ocean.

But there was another mishap before he left for Monaco, a mishap that gave him further confidence. While he and the same friend were trying out a new motor in a dinghy, the engine broke down and they drifted for two days before being picked up by a trawler. During this time Bombard drank a little sea-water: his friend drank nothing and when they were rescued was desperately thirsty. Bombard found he was not badly in need of water.

During a six months' stay at Monaco, Bombard analysed the details of shipwrecks and the case histories of survivors. A study of winds and currents was made and particular attention given to means of living off the sea.

"The ocean supplies three things: sea-water, fish and plankton." If sea-water is drunk in large quantities it causes inflammation of the kidneys (nephritis) followed by death. But Bombard argued that the body can cope with a certain daily intake of salt; about as much as is contained in a pint and a half of sea water. As far as he could see, this daily quantity of sea-water could be taken for about five days, after which there would be serious danger of nephritis.

But the sea could supply fairly fresh drinking water in the form of the body fluids of fishes (other than sharks and rays). After taking to the boats several days might pass before fish would gather around, and during this time the shipwrecked person would need to drink sea-water to maintain the water balance of the body. As soon as fishes could be caught, their body fluids could be tapped and Bombard estimated that the daily water requirements of one person could be expressed from six to seven pounds of fish.

Regarding food, fish flesh would supply ample proteins and fats. A source of carbohydrates was a problem, but given fair quantities of meat, fat and water the body could build up the necessary carbohydrates. "I had one encouraging example, that of the Eskimos, who for six months of the polar winter eat only meat and fat and drink melted sea-water ice, without seeming to suffer any serious consequences to their digestion." Lastly fish flesh and planktonic animals, the latter of which could be caught in a tow net, would supply nearly all the vitamin requirements of the body. While at Monaco Bombard was trying out this diet and grew more and more confident. "In the laboratory, at least, it seemed that my theory was completely sound. By a miracle I had managed to keep my project more or less secret, although in this I may have been helped by the polite disbelief and benevolent incredulity of those who knew about it. I was yet to discover that I was the only person who really believed in what I was doing."

The experiment to test out this theory began on 25 May 1952, near Monaco, when Bombard and his colleague Jack Palmer were towed out to sea in a rubber dinghy measuring about 15 feet long and 6 feet wide. The bows and the sides of the dinghy consisted of an inflatable U-shaped rubber tube divided into five sections by rubber bulkheads: there was a flooring of lightweight wooden deck-board and the open end of the U was closed by a wooden stern board. A mast in the bows carried a dinghy sail of about three square yards, a rig that made it impossible to sail into the wind. The two men had fishing lines and harpoons, plankton nets, a radio transmitter and receiver, navigation instruments and a sealed box of rations.

Their boat was called *l'Hérétique*, a name thoughtfully given by Bombard. "This first heresy particularly affected the professional seamen and navigators, who assured us we would never get further than the Iles d'Hyères. More particularly, I was attacking the general belief that it was impossible to live on the resources of the sea alone and that sea-water was undrinkable. Moreover (to repeat the comments made in one of the more reputable publications), when even experienced seamen never felt absolutely confident of their ability to combat the dangers of sea, wind and currents, a rank amateur was not hesitating to trust his companion's life and his own to a ridiculous cockleshell whose design had not even been approved by a qualified marine surveyor."

They were not driven back to land and they sailed from Monaco to Tangier, stopping at Minorca and Majorca on the way. Between Monaco and their approach to Minorca, from May 25 to June 9 they had to exist on spoonfuls of plankton, two large sea perches and a few rations got from a ship on June 7. From May 25 to 28 they drank sea-water; then for two days they existed on fish flesh and juices, then followed six more days of sea-water and then came two more days of fish. During this time Bombard was making careful notes on their state of health.

While they were at Tangier, Bombard's colleague decided he would not take part in the Atlantic experiment. So Bombard left Tangier on August 13 and, after a frightening course out to sea and back to land again, found himself off Cape Spartel on Friday 15th. On Wednesday, August 20, he arrived at Casablanca, having caught plenty of fish on the way. Leaving Casablanca on the 24th he arrived at the Canary Islands on September 3. On October 19, when the trade wind was blowing steadily from N.N.E. he set sail for the crossing.

After the fifth day the dinghy was surrounded by dolphins (*Coryphaena*) and other fishes and from then on he had food and liquid. But there was always the danger from the sea and possible danger from curious whales and sharks and playful sword fishes.

On December 8, after a particularly depressing period, Bombard estimated that he was about 120 miles from the West Indies. Two days later he was sighted by a ship and learnt that he had underestimated this distance by some 600 miles. Having accepted a shower, and a meal which later gave him frightful stomach pains, he continued on his way and eventually reached Barbados on December 23, with his box of rations untouched.

It took him 65 days to sail from the Canaries to the West Indies. (From Monaco to the West Indies he drank sea-water for a total of 14 days and fish juices for 43 days.) During the Atlantic crossing there were 14 days when he suffered from diarrhoea and haemorrhages. His skin became dry and a rash developed which covered the whole of his body. His sight was affected, he became anaemic and lost 55 lb. in weight. But he got there and was able to walk two miles soon after arrival.

The extraordinary courage and determination of Dr. Bombard are simply obvious. But it needs to be stressed that he was treated as a joke and had to contend with hostility and the finger-wagging of experts when he was on land. Now his experiment must be given keen attention, for in collaboration with the French Naval Authorities, he is producing a handbook for the use of shipwrecked people. (The statement that the frigate bird flies no more than 300 miles from the land will not appear in this raft book.)[1]

It is interesting to compare the voyage of *Kon-Tiki* with that of *l'Hérétique*. Heyerdahl's raft was carried northwards in the Peru Current and then

[1] Bombard found frigate birds fifteen hundred miles from the land.

westwards across the Pacific in the South Equatorial Current: Bombard went south in the Canary Current and then westwards in the North Equatorial Current System. Both the Peru and Canary Currents run along coasts where there is considerable upwelling of nutrient salts, leading to a rich development of planktonic life.

Following now the track of *Kon-Tiki* across the Pacific, much of the voyage was roughly along the parallel of 10° S.; the track of *l'Hérétique* over the Atlantic was roughly along the latitude 15° N.

In the equatorial regions the trade winds drive the west-going north and south equatorial currents, while between these two currents, in the region of equatorial calms there is an east-going counter current. Theoretical studies suggest that in such a current complex, frictional forces will tend to set up two regions of divergence, one north of the equator between the North Equatorial Current and the Counter Current, the other roughly on the equator within the body of the South Equatorial Current. At these divergences—regions where the waters are flowing apart—there will be a compensating upwelling of water from below. As nutrient salts tend to accumulate in the deeper waters, this vertical movement should result in the refreshing of the surface waters (those in which the microscopic plants grow vigorously) with such nutrient salts as phosphates and nitrates.

The work of the *Carnegie* in the Pacific showed that there were greater concentrations of plankton at these regions of divergence. Considering only the divergence just south of the equator, Professor Hutchinson has suggested that the great catches of sperm whales by the nineteenth century whalers between latitudes 2° N. and 4° S. ("On the line" whaling) are related to the upwelling in the divergence.[1] There are also good indications that within this divergence tunny fishing is particularly profitable. It is reasonable to expect these wide-ranging oceanic creatures to "know" the biological structure of their environment.

How far were Heyerdahl and his colleagues deriving some benefit from the equatorial divergence in the form of good catches of fish? The *Dana* obtained rich hauls of plankton along a line running from the Galapagos Islands to the Marquesas Islands: south of latitude 10° in an area between Fiji and Tahiti, the catches were poor.[2]

But it is Bombard's achievement that must be assessed. How far was he fortunate in his "choice" of an Atlantic crossing? The theoretical studies of Defant suggest that the divergence north of the equator is centred at 10° N. Bombard's course from Tangier to north of the Cape Verde Islands was in waters known to be very productive of marine life, but was his crossing just north of 15° N. in plankton rich waters? We do not know whether the effects of the divergence extend northward over 5° of latitude. But there is some evidence from the *Dana* work that the waters W.S.W. of the Cape Verde Islands carry more plankton than those between the Azores and Bermuda or those between Maderia and Martinique.[2]

If we conclude that the Atlantic course of *l'Hérétique* may have been in moderately fertile waters, how are we to view Bombard's claim "to have proved that the sea itself provides sufficient food and drink to enable the battle for survival to be fought with perfect confidence"? It must be said at once that

[1] Hutchinson, G. E. (1950). "Survey of contemporary knowledge of biogeochemistry: 3. The biogeochemistry of vertebrate excretion," *Bull. Amer. Mus. Nat. Hist.* 96.

[2] Jespersen, P. (1935). "Quantitative investigations on the distribution of microplankton in different oceanic regions," *Dana-Rep.* no. 7, 1–44.

he and his colleague were able to exist for a fortnight in the western Mediterranean where less sea produce was forthcoming. On the other hand, there is considerable evidence that the eastern Mediterranean supports less oceanic life than the western half.

Clearly the ocean has a biological structure, some regions being more productive than others. It would be unwise to generalize from the experience gained by Heyerdahl and Bombard in the equatorial regions. But it is Bombard's achievement to have devised a technique for survival and to have had the moral and physical courage to try it out. He has vividly seen the importance of morale for a shipwrecked person. "Helpless in the night, chilled by sea and wind, terrified by the solitude, by noise and by silence, he takes less than three days to surrender his life." Bombard has shown that if he turns from his misery to the sea and its life there is a good chance of his surviving to be picked up or to reach land.

N. B. MARSHALL

REVIEWS

EUROPE

GEOLOGY AND SCENERY IN BRITAIN. By T. G. MILLER. *London: B. T. Batsford Ltd.*, 1953. 9×5½ *inches;* 224 *pages; maps, diagrams and photographs.* 18*s*

Although the author says in his preface that he will "strike a balance between the purely geological regional survey and the more ramifying 'country book' with its excursions into local history, architecture and anecdotes," the only excursions he has permitted himself are in fact kept closely relevant to either rocks or scenery. In this way he has made a much more worth-while contribution to the understanding of the British scene than if he had succumbed to the temptation of garrulous anecdotage. Britain, in the title, means England and Wales, but geology and scenery, even of this restricted region, is a topic demanding for adequate treatment the whole of the book's 220 pages. Thus by rationing irrelevance, by allowing the rocks to talk for themselves and by drawing liberally on personal observation and a wide acquaintance with the surface of England and Wales he has succeeded in offering to his readers a great deal of information made very palatable by an infectious enthusiasm for his subject. It will not be easy going for the uninitiated reader, who must study Part I (The Rules) with due care and attention to get himself into a position to understand Parts II and III (The Highlands and the Lowlands).

The point of view, even in the interpretation of relief, is characteristically that of the geologist, confident that anything in the landscape can easily be explained by the operation of "differential erosion" on "geological structure," without distinguishing the hall-mark of each "process" or defining the "stage" in evolution attained. For example more attention is paid to the metamorphism of the Killas and the mineralization of the granite than to the remarkable scenic features produced by rejuvenation in the Dartmoor rivers, and to the Towy anticline than to the ancient upland plains that in spite of structural differences dominate the relief over much of Mid-Wales. Coastal scenery as such gets little notice beyond the geological structures revealed in the cliffs and the mention of loss by erosion on the Lincolnshire (*sic*) coast between Flamborough Head and Spurn Head. Refinements of relief analysis are clearly not possible in a study of this size, and no doubt it is also the necessity for brevity that has led to over-

simplification and to the ignoring of contributory factors in the explanation of land forms of complex or controversial origin, as when the impression is given that the Goring Gap is essentially a glacial overflow channel or when periglacial drainage on frozen chalk is confidently offered as a complete and satisfactory explanation of dry valleys.

The style is lively with some happy phrases and touches of dry humour; the photographic illustrations, often from unfamiliar angles, are beautiful and most revealing; the simplified geological maps and some structural diagrams are very helpful, but the latter present some peculiar optical illusions which might have been avoided by more careful attention to the principles of perspective drawing.

A. A. M.

SANDY SHORES IN SOUTH LANCASHIRE. By R. KAY GRESSWELL. *Liverpool: University Press*, 1953. $8\frac{1}{2} \times 5$ *inches;* xii + 194 *pages; maps, diagrams and illustrations.* 30*s*

This book on the South Lancashire coast is welcome. The author has spent a great deal of time studying the changes of the beach, the river Alt, the dunes and related phenomena, and no one knows the stretch between Ribble and Mersey better than he does. The book, then, is the outcome of prolonged field-work and it bears the stamp of authority.

Not only is the present shore discussed, but also those of earlier times. The Hillhouse cliff is fronted by a beach of Shirdley Hill Sand and Downholland silt overlain by peat. This line also enclosed the bay in which Martin Mere is situated. At 25–100 feet O.D. is the Scarisbrick–Mawdsley level covered with boulder clay and, in its southern part, overblown by Shirdley Hill Sand. This is backed by old cliffs leading upwards to the Chorley–Skelmesdale platform at 200–250 feet. At higher levels are the Ashhurst–Parbold platform at some 500 feet, the Wheelton at 500–780 feet, and finally the Anglezarke moor summits at 900–1300 feet. Each line of rise has been traced carefully on the ground.

The effects of winds and waves, and especially of their relations to the length of fetch are fully analysed, and the key position of Formby Point receives proper emphasis. Particular attention based upon prolonged study and detailed measurements is given to the fulls and their evolution.

Studies of this kind are wanted for other parts of our coast, and it is to be hoped that they will each find such a devoted investigator as Mr. Gresswell. One of the difficulties is the publication of these detailed studies. Valuable though they are, they hardly come under the heading of "Best Sellers." It is satisfactory indeed that the Liverpool University Press has sponsored this work.

The plates are admirable; most are from the author's own photographs. The text figures are usually clear, but in a few, *e.g.* 18, 22, 37, some of the words are not easy to read, and Mr. Gresswell does not always express himself as clearly as he might. These however are small criticisms and in no way mar the book as a whole.

J. A. S.

A SCIENTIFIC SURVEY OF MERSEYSIDE. Edited by WILFRED SMITH. *Published for the British Association by the University Press of Liverpool*, 1953. $9\frac{1}{2} \times 7\frac{1}{2}$ *inches;* xv + 299 *pages; maps and illustrations.* 21*s*

BOLTON SURVEY. General editor: C. H. SAXELBY. *Bolton: published under the auspices of the Bolton Branches of the Geographical and Historical Associations and Bolton Field Naturalists Society*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 140 *pages; illustrations and maps.* 8*s* 6*d*

The first of these publications has already received well-deserved praise and it forms a fitting culmination to a notable series of post-war Surveys which have

been prepared under the auspices of the British Association, including those covering North-eastern England, as well as the Birmingham and Belfast regions. It is significant that in all these cases the works have been planned by geographers who have also contributed much, if not most, of the actual material; and lest it should be assumed that such has always been the case, it is useful to remind ourselves that on the occasion of the last visit of the Association to Liverpool (actually in 1923), there was not a single contribution from a professed geographer to the handbook then produced.

Apart from its wealth of information written by some two dozen contributors, and its illuminating maps and diagrams, the work of the Liverpool Department of Geography, one of the most notable features of this handsome volume is the discerning introduction written by Professor Wilfred Smith on the area as a whole which not only summarizes so clearly some of the essential requirements for a regional study but also sets the scene so admirably for all that follows. Like any other part of the earth's surface Merseyside is a little world in itself which can be fully comprehended only by reference to many fields of knowledge, and here we have a model of how such an interpretation may be attempted.

As regards physical landscape, Merseyside, though in the north of England, is not of it. Again, as regards social structure, Liverpool is not typical of Lancashire; and "by reason of the large immigrant population of Irish, Welsh, Scots, foreign and colonial nationals, its speech is not typical either." Economically, Merseyside is described as "an urban and industrial island created by the port and superimposed on a landscape of good husbandry" and as such it is a very different place from Greater Manchester. Changes are assuredly taking place, and the industrial structure of Merseyside is acquiring greater diversity; but one feature of great significance is that many of the "new" manufacturing industries (*e.g.* metal safes and non-ferrous metals, rubber goods, vehicle assembly and machinery, industrial chemicals) are now "located on Merseyside as a conurbation rather than on Merseyside as a port."

The Bolton Survey represents a very praiseworthy cooperative effort on the part of the local branches of the Geographical and Historical Associations, as well as the Bolton Field Naturalists Society, with the active support of other local authorities to stimulate interest in the area and encourage the formation of a body of more serious enquiry into the many aspects of its life. This attractively produced book, though short, covers a diversity of subjects including the physical background, historical development and the multifarious modern activities, and at the end there are suggestions for further research. In connection with the latter the hope may be expressed that studies in the historical geography of various periods of growth and of various industries will not be overlooked and that a rather less pronounced deterministic attitude regarding the operation of what are called "geographical influences" will be encouraged. R. H. K.

A GEOGRAPHY OF EUROPE. Edited by GEORGE W. HOFFMAN. *London: Methuen* (*New York: The Ronald Press Co.*), 1953. 9×6½ *inches;* iv+775 *pages; maps and photographs.* 52*s* 6*d*

To compile a regional textbook from a collection of essays is not easy and to write it on the whole of Europe and Russia as far east as the Urals is a formidable task. Yet the authors of this work have achieved considerable success in their chapters, three of which are general and seven are regional surveys of the continent. The editor is to be congratulated on the broad uniformity of text, maps and statistics. The introductory chapter by Professor W. G. East, entitled "The Historical Background," is a useful summary of historical legacies, from

which the contemporary patterns of political states, languages, population, urban and rural settlements and the European economy may be understood. Such diversities indicate "how little unity except in the formal sense of territorial continuity the term 'Europe' connotes." The second introductory chapter by Professor N. A. Bengston on "The Physical Background" is treated very broadly and with a conventional approach. It is disappointing that only scant reference is made to the modern interpretation of climatic data by the nature of the air masses. Some of the generalizations are questionable, such as the distribution of alpine glaciation (page 98), especially in the Iberian Peninsula.

The bulk of the book is devoted to the regional description of the major units of Europe, which it divides into seven areas. Each of these chapters has been written by a European-trained specialist interested in the area he has written. Nevertheless standards of regional description vary considerably from general information to studies of more penetrating insight. The chapters dealing with the British Isles by Professor F. Kenneth Hare, Northern, Central and East Central Europe by Professors V. H. Malmström, G. W. Hoffman and G. Teleki, respectively, are excellent summaries. The post-war changes outlined in the chapters dealing with the countries behind the Iron Curtain are particularly welcome. But the reader may wonder why it is thought necessary to devote space to such topics as the national temperament in Spain, alcoholism in France and women's status in Greece. Such aberrations offer grounds to those critics who regard regional geography as a miscellanea of interesting information and current affairs.

The book emphasizes economic considerations within the physical and historical context of each major area. It is therefore appropriate that the concluding chapter by Professor H. H. Schloss should be on "Europe in the World's Economy." Against a general background of modern economic history which partly goes over the ground of the opening chapter, the areal features of European demography, industry, agriculture and commerce are outlined. It is a useful commentary on the problems of Europe today and tomorrow.

The student will learn much of value in this broad survey of Europe. Seventy-three maps and photographs well illustrate the text, and the statistical data and references provide up-to-date information for a continent in process of rapid change. By its very bulk the book should be on the reference shelf and the detailed index will help this purpose. But the student, disturbed by the treatment of regional geography in many textbooks, may still feel uneasy when he has completed reading this book. J. M. H.

FARMING IN FINLAND. By W. R. MEAD. *University of London, the Athlone Press*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xv+248 *pages; maps and diagrams.* 30*s*

Few states are so unfortunately placed in Europe but the deep-rooted independence of the Finns has earned the respect of all her neighbours, as well as of friends farther away. As Dr. Mead points out, the U.S.S.R., Sweden and Canada have within their borders a type of physical environment similar to that of Finland, but no other country lies entirely in latitude 60°–70°. Lacking the capital for full industrial development, and even for agricultural improvement, the Finns have two sets of problems—first, those of physical geography, and second, the recent loss of territory inhabited by one-tenth of their population. On the physical side much can be done by research (and incidentally Dr. Mead shows the contribution that Finnish geographers—not always heeded—have made to the welfare of their country): Finland acquires "a province in a century" by isostatic uplift and almost as much land as that reclaimed from the

sea can be added by deep drainage. The reclamation of swamps appears to be more profitable than the reclamation of forest—and the forest is a resource closely associated with farming. Methods of farm reclamation range from the primitive but traditional "burnbeating" and bog firing to the use of elaborate modern machinery.

Agricultural self-sufficiency is desired in Finland as a means of political protection and therefore everything possible must be grown at home. New farms have been made under various state schemes, partly by reclamation and partly by division of the larger existing holdings. On p. 201 it is said that the 7 per cent. of Finland's farms recently sub-divided are drawn from the 15,571 farms having more than 50 hectares (*c.* 130 acres) of cultivated land, that is from the farms which have the greatest marketable surplus of produce. Is a farm of 6–7 hectares (*c.* 16 acres) really an economic unit? The Danes and Swedes do not think so; but at present there are thousands of people evacuated from areas given to Russia for whom some land must be found. This book brings before the reader these fascinating problems: it is attractively written, well illustrated (though three Finlands on a page give rather a congested effect) and adequately documented, though the sources of the maps are given in the heart of the text instead of in the underlines.

As in most books on agriculture, the practice of treating grassland farming and cropping in separate chapters leads to a division more apparent than real; and the present reviewer would have liked to see farms of various sizes treated regionally, with some indication of the number of stock kept on typical farms (if there are such), and some indication of methods of marketing produce. But any work that arouses curiosity is in itself good, and one hopes that Dr. Mead will give us further studies on forestry, rural forest industries, and on towns and industries. Perhaps the author may even be tempted to show us if there is an "urban hierarchy" in Finland and whether the rural cooperative organization carries many of the functions of towns deep into the countryside. It is mentioned incidentally that many of the major industrial enterprises, conspicuously those associated with forestry, are located far from towns and that many "farmers" are part-time workers in industrial or other occupations. With great respect, one asks for more from Dr. Mead who clearly has what Sir Halford Mackinder called a "loving familiarity" with Finland. T. W. F.

HELGOLAND UND DIE HELGOLÄNDER. By B. E. Siebs and E. Wohlenberg. (*Veröffentlichungen der Schleswig-Holsteinischen Universitätsgesellschaft*. No. 5.) *Kiel: Ferdinand Hirt*, 1953. 9×6½ *inches; 304 pages; diagrams, maps and illustrations*

Among the many islands of the world Heligoland will always hold a special place quite disproportionate to its size. Now that, after the threat of complete destruction, a new chapter has begun in the life story of this "remarkable isle" —as it was called in the first written document referring to it a millenium ago— the appearance of this book on its nature and its people occurs at a most appropriate moment. This is not an absolutely new book since the second part on the people and their origin, lore and language (written by B. E. Siebs), is a revision of a monograph originally published in 1928. Though this part is no doubt also valuable to the geographer for an understanding of this little isle, it is the newly added first part on the natural basis and the man-made landscape (written by E. Wohlenberg) which will interest a geographer first of all. Considering the number of aspects touched upon in this first part, which includes also sections on plant and animal life and on the Biological Research Station, no comprehensive and detailed treatment should be expected. Nevertheless,

Wohlenberg succeeds in presenting a picture of the isle which is clear and vivid and will hold the attention of the professional geographer and the general reader alike. Particularly interesting, at any rate to the geographer, are the first section on the early geomorphological history of the area which later became the twin isle of Heligoland (the Red Cliff) and the Dune (formerly the White Cliff); the sections on its later phases during historic times; and the last section which, understandably with a sad undertone, gives an account of the most destructive phase, the great blasting in 1947 and the use of the isle as a bombing range until it was handed back to Germany on 1 March 1952. Highly praised must be the numerous carefully chosen and beautifully printed photographs, reproductions of many early maps and pictures, and the small but clearly legible and instructive maps and diagrams which make a perusal of the book worth while even with no knowledge of German. It is unfortunate however that there is no list of the illustrations. An extensive bibliography makes it easy to follow any particular question further. It can justly be said that this book on Heligoland is a most pleasing publication which will appeal to many tastes. Its publisher, Ferdinand Hirt, formerly at Breslau and well known to geographers from pre-war days, has shown that in his new location the technical standard aimed at is again remarkably high. K. A. S.

ASIA

L'ASIE. By PIERRE GOUROU (Les Cinq Parties du Monde). *Paris: Hachette*, 1953. 9 × 5½ *inches; 541 pages; maps, photographs and diagrams*

As a continent, Asia does not easily lend itself to systematic description, but within the limits chosen (excluding Soviet Asia) Professor Gourou's study is undoubtedly one of the most successful so far attempted. He writes in the classical tradition of French geography: a balanced and lucid exposition of physical and human aspects, including much regional and economic detail, rounded off by a brief consideration of political and social questions. The work is divided into a general section dealing with structure, climate and social geography; and five regional sections—China, Central Asia and Korea; Japan; South-eastern Asia; the Indian sub-continent; and South-western Asia. Russian Asia, it is explained, is to be treated with Europe in the fourth volume of the series.

There is much interesting regional detail—village settlement, demographic trends, and even the girth of sacred trees—combined with discussion of wider issues such as the future of Japan, and the moral right of Arab sheiks to retention of oil royalties. Although replete with parenthetical figures and at times highly compressed in statement, 'L'Asie' gives a remarkably complete yet detailed picture of contemporary Asia in its human setting. The impression of a work of reference, produced at times by the numerous statistics and short sentences, is more than redeemed by a pithy comment, or suggestive generalization—stockrearing in India as "misérable et luxueux," or the Japanese "know very well that a high level of consumption is not essential to the spread of knowledge, or to the attainment of a high level of intellectual and moral qualities."

Professor Gourou is perhaps most successful in his treatment of India, South-eastern Asia and Japan. His chapters on the social organization of the Indian village give reality to such matters as the detailed operation of caste system, and methods of agricultural exploitation, which we tend often to know merely as generalizations or abstractions. For Japan, there is a brief but illuminating

discussion of the position of industry since 1945, and a "case-study" of agricultural life in a particular village. French Indo-China and Indonesia also receive a rather more extensive treatment than has been the case in some previous studies of Asia.

Inevitably, statistics relating to Asia are difficult to obtain, and often unequal in value—hence on occasion Professor Gourou includes figures of the 1930's and even 1920's as indices of current developments. But he is to be congratulated on the relative abundance of really up-to-date statistics, and his knowledge of detailed post-1945 developments compels admiration. 'L'Asie,' though occasionally too compressed in statement in an attempt to treat all aspects, is a major contribution to the literature of this region. By reason of his forceful endeavour to compel reflection on the part of the reader, and his adroit handling of human and physical elements, Professor Gourou has achieved much more than a descriptive text—his book is a demonstration of the value and possibilities in modern geography. W. B. F.

HORNED MOON. By IAN STEPHENS. *London: Chatto & Windus*, 1953. *6×9 inches; 277 pages; coloured and black-and-white photographs. 21s*

This book is described on the fly-leaf as an "account of a journey through Pakistan, Kashmir and Afghanistan," but it is really more than this. The author has used his travels as a background to a considerable amount of autobiography.

Mr. Stephens, who was Editor of the *Statesman* in Calcutta from 1942 to 1951, describes, amongst other things, the difficulty of remaining impartial in a self-conscious new Dominion. The *Statesman*, under his guidance, was never loth to criticize the Government, but he found that after 1947 conditions were very different and the account of his interview with the last British Governor-General of India makes interesting reading. Ultimately the position became so untenable that Mr. Stephens resigned and, whatever his sentiments may have been before, it seems probable that his treatment in India largely accounts for his enthusiastic adoption of the cause of Pakistan.

One of the points he raises is the cleverness of the present leaders of the Indian Republic in retaining the name of "India" for external use, whatever term might be adopted for internal consumption. It not only suggests that they are the true and legal successors of the old régime, but also it is the source of many misunderstandings and much annoyance to Pakistan. To overcome this Mr. Stephens has invented the word "Delkaria" to describe the whole sub-continent and this term he uses throughout his book.

Mr. Stephens was very fortunate in having interviews with many of the outstanding men of Pakistan and elsewhere and he gives interesting character studies of these leaders, upon whom so much depends. In addition he made a point of talking to all types of people, ranging from senior Army officers to Mahsud tribesmen, so that his comments are always more than a mere expression of official views and may, I think, be taken to be a fair account of public opinion in Pakistan today.

It must not be thought that the book is all politics but, while the author's travels were in countries geographically well known, they covered territory which is politically less familiar than it used to be. His descriptions of Gilgit, Hunza and Nagar, Kashmir and Waziristan are interesting and he was indeed fortunate in the time of year, since the beauty of the high valleys of the Himalayas in springtime can rarely be excelled. Mr. Stephens succeeded in his plan to cross the cease-fire line in Kashmir and his account of conditions on either side is most enlightening. Wherever he went he was received with the utmost courtesy and kindness, to which he gives full recognition in this book.

It is perhaps unfortunate that the author's love for the people of Pakistan has led him to make a number of somewhat querulous remarks about his own countrymen. The high opinion which the average Pakistani or Indian had of those who served in the former Indian Administration is sufficient answer to such comments ; they add nothing to the value of this book and are more likely to alienate the reader, to whatever race he may belong, than to please the Pakistanis. Apart from this and a somewhat florid literary style, 'Horned moon' will be enjoyed by anyone who wishes to learn more about the affairs of Pakistan, as seen by a well-informed visitor in 1952. J. E. F. G.

BEITRÄGE ZUR HISTORISCHEN GEOGRAPHIE DES VORISLAMISCHEN SÜDARABIEN. By H. VON WISSMANN UND M. HÖFNER. (Akad. der Wiss. und der Lit. in Mainz, Abh. d. geistes- und sozialwiss. Kl. Jahrg. 1952, Nr. 4.) *Wiesbaden:* 1953. 10×7 *inches;* 167 *pages; plates and maps*

GEOGRAPHISCHE GRUNDLAGEN UND FRÜHZEIT DER GESCHICHTE SÜDARABIENS. By H. VON WISSMANN. *Saeculum*, Bd. 4 (1953 ; 10×7 *inches;* Hf. 1), 61–114 *pages*

The cartography of South-western Arabia has hitherto lagged far behind that of the rest of western Asia. We possess, it is true, a number of travellers' charts covering limited areas. But there has up to now been no general map of South-western Arabia on which the slightest reliance could be placed, and the correlation of the various travellers' charts is a task beyond the competence of the ordinary student. The first of the works here noticed, the *Beiträge*, notably fills this gap: one of its maps is a small-scale sketch of South Arabia in about the fourth century B.C. (this is reproduced also in the *Geographische Grundlagen*), which will probably be of interest mainly to epigraphists; but the second is a detailed map of the whole area between a meridian slightly east of Ṣan'ā, and Shibām in the Ḥaḍramaut, and this will be an immense boon to all students of the region. Its scale is approximately one in a million, and it is very easy to read in spite of the immense amount of information which is packed into it.

The text of the *Beiträge* takes the reader on a tour of South Arabia starting at Najrān and ending in the lower part of the Wādī Ḥaḍramaut. For each area we are given a minute description of the topography, a discussion of the ancient nomenclature based both on the pre-Islamic inscriptions and on the Greek geographers, and a short sketch of its pre-Islamic history. It is unfortunate that a large part of the copious documentation is rendered quite useless by the fact that the authors have omitted to give the page-reference of the work cited (the same criticism applies to the *Geogr. Grundlagen*). Apart from this, the *Beiträge* constitutes a rich mine of information not only for epigraphists but also for students of Greek geography and of present-day South Arabia; for in a number of cases the tribal frontiers of today coincide with the ancient political boundaries.

The work is divided into three chapters, dealing respectively with Ma'īn and Saba (*i.e.* the South Arabian Jauf, the Mārib and neighbouring oases, and the Yemeni highlands), with Qatabān and Ausān (the Wādīs Baiḥān and Ḥarīb, and the territory between them and the sea), and Ḥaḍramaut. The treatment of chapters 2 and 3 is admirable, but Ma'īn and Saba receive somewhat inadequate attention. They are disposed of in 26 pages, contrasting with 106 allotted to chapters 2 and 3, in spite of the fact that Ma'īn and Saba together were historically of equal if not greater importance than the other areas in the development of pre-Islamic South Arabia.

It may be that this arrangement was imposed on the authors by the fact that Ma'īn and Saba lay entirely within the present-day political boundaries of

Yemen, a country which is to all intents and purposes closed to scientific research. But even this hardly excuses one serious omission: no allusion is made in the text to the Wādī Baun with its chain of historical sites of the first importance. From Ma'īn westwards, a line of pre-Islamic sites stretches along the course of the Wādī Madhāb as far as Medīnet el-Baiḍā (the classical Nesca, epigraphic NŠQ). At this point the Wādī Madhāb is joined by two wadis flowing in from a roughly south-west direction: the Wādī Hirrān and the much longer Wādī Baun, which curves round until it runs nearly north–south and rises in the Yemeni highlands to the north-west of Ṣan'ā. The whole of this wādī system is full of ancient sites of great importance: Hirrān, the shrine of "Ilmuqah of Hirrān" whose cult was prominent in the middle-Sabaean period round about the beginning of the Christian era; Dhū-Bīn, 'Ukāniṭ and Raidat, all sources of inscriptions; Nā'iṭ, visited and partly excavated by an Egyptian archaeological expedition, as described by K. Y. Nāmī ('Nashar nuqūsh sāmīyah qadīmah,' Cairo, 1943), together with the adjoining Jebel Thanain, an ancient shrine and apparently the headquarters of the Hamdanid tribal confederacy; and 'Amrān, from which a large number of the votive-plaques now in the British Museum originated. These sites in the Wādīs Hirrān and Baun are marked in map 1, but neither text nor index contains any mention of them.

The *Geographische Grundlagen* devotes less attention to specifically geographical questions, though its first section (pp. 61–70) does give an illuminating description of how the natural features of South Arabia have conditioned its human geography and history. The remainder covers in the main the same ground as the *Beiträge*, but more succinctly, by omitting most of the topographical and epigraphical detail and reproducing simply the historical and cultural outlines. In this respect it provides a useful and readable introduction to the study of pre-Islamic South Arabian antiquity. But it must be used with some caution, since the omission of the supporting arguments means that the reader is unable to control the statements made, and in some cases the author's conclusions go further than the evidence warrants.

For instance, on page 104 it stated that "Als Besitzer von Aden und der Küste bis Bab el-Mandeb war Qatabān damals [*i.e.* in the third and early second centuries B.C.] gewiss auch Herr in Ostafrika." This seems to be a further development of the view expressed in the *Beiträge* (p. 74), according to which Ausān (a kingdom situated in the highlands between Qatabān and the sea) had somewhat earlier "auch ein Kolonialreich in Ostafrika gegründet"; and the ground there alleged for this view is the fact that the Periplus applies the name "Ausanite" to a part of the East African coast. Such a view depends on an erroneous deduction concerning the nature of the Semitic immigration into East Africa. The existence of place-names in East Africa reproducing names known in South Arabia is not sufficient evidence to prove that this movement was in any real sense a colonizing policy. It is altogether more probable that it represented a tribal migration comparable rather with the settlement of the Saxons in England, than with, for instance, European colonizing activities in the Americas. It seems to me most unlikely that the ancient South Arabian kingdoms exercised at any time a political control over the settlers in East Africa. A. F. L. B.

LANDLORD AND PEASANT IN PERSIA. By A. K. S. LAMBTON. *London: Geoffrey Cumberlege, Oxford University Press*, 1953. $8\frac{1}{4} \times 5\frac{1}{2}$ *inches;* xxxi+459 *pages; map.* 44*s*

Dr. Lambton's survey of the history and present condition of Persia's agricultural economy is likely to remain the last word on the subject for a long time to

come. Her theme is confused and complicated to a degree by the political vicissitudes of thirteen centuries, by the theorizing of a host of Arab and Persian jurists, philosophers, statesmen and historians and by the diversity of races, climates and soils found in a sparsely populated country of great distances and bad communications. But the author's erudition matches the complexity of her subject; it may safely be judged from her bibliography, which includes 21 major Persian and Arabic manuscript books and documents, 109 printed or lithographed works in the same languages, and a most comprehensive list of Western books, treatises, and articles published in five different European languages between 1664 and the present day.

In the first seven chapters of her book the writer, after a brief account of the feudal systems of the Achaemenian, Parthian and Sasanian empires, traces the growth and decay of various systems of land tenure, taxation and rural organization from the Arab conquest in the seventh century to the "Constitutional" revolution of 1906. The tale is a grim one of a human stock engaged in a struggle for existence through the ages in a hostile world of drought and locust, earthquake and epidemic, civil war and foreign conquest, a struggle against selfish and arrogant landlords, rapacious tax-farmers, corrupt law courts and the emissaries of Sultans and Shahs who claimed a "divine right to govern wrong." Dr. Lambton traces in much detail the evolution of Islamic theory in the Arab period (seventh to tenth centuries) according to which all conquered and ownerless land belonged to the Muslim community and could only be alienated by the Imam in the interests of the community. The Seljuk (Turkish) and Mongol conquerors in the four centuries which followed applied the "theory of the steppe" that all land belonged to the Khan as representative of the tribe, a doctrine improved upon by the Safavid Shahs in the sixteenth and seventeenth centuries who claimed absolute, almost divine, ownership of the soil. The result was that the peasants, who through their village headmen up till then had had some say in their own affairs, were gradually depressed to the status of serfs tied to the land. Dr. Lambton describes vividly from contemporary sources the evils of the *tuyūl* (land-revenue assignment) system which culminated in the cruelties and oppressions of the Qajar Shahs, a race whose ruthless despotism influenced every grade of official, landlord and *tuyūldar* in the country. The abolition of *tuyūls* and the other reforms which resulted from the "Constitutional" revolution of 1906–7, and still more the administrative, social and economic changes forced upon a bewildered Persia by Reza Shah Pahlevi, greatly improved the lot of the peasantry. It is true that the rapacity of underpaid officials of the new Shah's Government to some extent offset the curbing of the greed of the landlords; that the Civil Code (which Dr. Lambton summarizes in Chapter IX) did little for the peasants; and that the scales of justice in the provinces were still weighted heavily in favour of the landlord. But compared with the period of the earlier Qajars, at any rate, the reign of the first Shah of the Pahlevi dynasty was a golden age.

In the second part of her book Dr. Lambton gives a very full and elaborately-documented account of Persia's land tenure system and rural organization at the present day. Chapters X–XXII are too full of statistics, Persian terms and quotations to make easy reading, but they throw new light on subjects of great interest to the student of modern Persian history, such as the ill-advised efforts of Reza Shah to abolish nomadism and settle the tribes of Fars and Azerbaijan on the land, and the sad story of the Central Government's attempts to distribute the Crown Lands of Zabul (Sistan) among the peasants. In the chapter on "The Large Landed Proprietors," one of the best in the book, Dr. Lambton describes the wide gulf which divides landlord from peasant in Persia even

today. The former, with a few notable exceptions, seldom considers the welfare of his tenants and labourers, whom he regards as merely a source of gain in money, political power, and social prestige; the peasant on his side, by his obstinate conservatism, plays into the hands of his oppressors. Faction strife is another obstacle to progress; in the author's words, "struggle between conflicting groups and interests is the keynote of Persian society."

In her concluding chapter on "The Future" Dr. Lambton lists the chief technical problems which must be tackled in order to increase production and so relieve the grinding poverty of the peasantry—improved roads and cheaper transport, better marketing arrangements and credit facilities, more up-to-date agricultural methods, improved and developed irrigation, water conservation and animal husbandry. She might have mentioned the insufficiently appreciated efforts of the British Middle East Office to help Persia in these spheres. On the administrative side she calls for reforms in the land-tenure system giving more security to the cultivator, and for measures such as the substitution of fixed rents for crop-sharing, the abolition of labour service (*bigar*), and the limitation of the size of estates. But the evils of the present situation in regard to land tenure and rural organization are inherent in the whole social system. "Nothing short of a fundamental change in the conception of society and the relation of the individual to society," says the writer, "is likely to bring about a reform of conditions." Those who know Persia best fear most that such a change is unlikely to be brought about by anything in the foreseeable future short of a revolution on Communist lines, with or without a third World War to facilitate it.

The book as a whole would have been better if the process of digestion had been carried a stage further. Some of the copious translations from laws and regulations, most of which, as the author herself says, were dead letters from the start, might have been relegated to appendices. The same applies to much of the wealth of facts and figures in the chapters on irrigation, lands held in trust (*ouqāf*), crown lands, crop-sharing, rents, *bigar* and other personal dues, payments to local officials, flocks and pastures, agricultural methods and debts. The author jumps from region to region, village to village at opposite ends of Persia in a fashion which leaves no clear picture in the mind. From the geographical point of view, too, the map is scarcely adequate; apart from a small inset roughly showing the relief of the country no physical features are shown, nor is there any indication of provincial boundaries. On the other hand nothing could be more scholarly than the documentation of the book throughout, and its glossary, bibliography and index leave nothing to be desired. These add greatly to the permanent value of the work as a book of reference on a most complex and little-known subject. C. P. S.

AFRICA

AFRICA: A STUDY IN TROPICAL DEVELOPMENT. By L. Dudley Stamp. *New York: John Wiley & Sons; London: Chapman & Hall,* 1953. 9×5½ *inches;* vi+568 *pages; maps and illustrations.* 68*s*

This book is essentially a survey aimed at considering Africa's "geographical background as an environment for human activity" and at studying the responses which have been evoked from Africans and others who have helped in moulding its fortunes. It is divided into three parts. Part 1 considers the broad features of the continent as a human environment; in Part 2 is an account of the regional geography of its component units; and Part 3 knits the whole together by reviewing past, present and future problems of the continent.

The field is vast indeed; and, but for the author's usual clear and concise style and the selective treatment he adopts, a much longer book would have been required. But even so, one is aware that a great deal that is vital has been treated inadequately, if not omitted. This is especially true of Part 2, where the greatest need and opportunities exist for giving workers in the field an accurate picture of what we know, or do not know, about the geography of this vast continent.

The African environment has recently shown how cruelly it can thwart those who take it too readily for granted. The need for caution seems now to have been acknowledged; and what planners now want is factual information to guide their steps. In general terms such guidance is provided in Part 1 of the book, where abundant material drawn from scattered sources, including the author's own studies, is brought together, and in telling phrases warnings are delivered on the pitfalls of the African environment. Few will dissent from the concluding plea of chapter 8 for "research and the realization that Africa still holds many problems common to the whole world besides a number, often the most baffling, of problems peculiarly its own."

Part 3 raises many interesting questions, but it is a pity that space prevents their full discussion; for some of them, such as the effects of modern economic conditions on traditional African society and recent developments like Mau-Mau, have deep origins and tremendous implications.

Such comments, however, cannot diminish the value of Professor Stamp's stimulating book, whose clear presentation and excellent plates and diagrams should enhance its appeal to all those—specialists and laymen—who are seriously interested in African development. E. A. B.

THE ZAMBESI JOURNAL OF JAMES STEWART, 1862–1863. Edited by J. P. R. WALLIS. (Central African Archives : Oppenheimer ; Ser. no. vi.) *London: Chatto & Windus*, 1952. 10×6½ *inches; 276 pages; frontispiece and map*

The story of Livingstone's Zambezi expedition of 1858–63 is a fascinating one for the student of human nature. In recent years a good deal of light has been thrown upon it by the work of the late Sir Reginald Coupland and by Professor Wallis' biography of Thomas Baines. Stewart's journal supplements this material, but does not substantially alter the general picture.

James Stewart, on a reconnaissance with a view to establishing a Free Kirk mission, joined the expedition at a moment when the difficulties and disappointments, which led to its withdrawal, were crowding upon it. The Zambezi and the Rovuma had proved to be no navigable routes to the interior; Lake Nyasa had been discovered, but the condition of the Shire prevented easy access; the region was ravaged by slave traders, and the Universities Mission had suffered severe set backs and several lives had been lost. All this disillusioned James Stewart, whose enthusiasm had been roused by Livingstone's personality, his earlier description of the Zambezi as a highway to the interior, and his suggestion that the region was potentially a great cotton growing area. It is little wonder therefore that Stewart, reserved, self-questioning, rigid on points of theology, and shaken by bouts of fever, had a difficult re-adjustment to make. From the point of view of the expedition, it was hard not to regard him as an intruder at a particularly difficult time. In common with others, Stewart allotted responsibility for much of the personal troubles to Livingstone's brother, Charles, "the one mistake of the expedition." With David, relations were rarely cordial and often strained, but in the end Stewart arrived at a balanced estimate. He perceived that Livingstone's great gifts did not include

that of organization, and considered that much time and material was wasted through lack of foresight. Livingstone's administrative ability "seems to fail when brought in upon other minds who will think as well as himself, though not possessing the same determination." Stewart accomplished little on this journey, but he lived to play a decisive part in the history of Nyasaland and, in doing so, honoured the memory of the great explorer and missionary. Professor Wallis has confined his editorial work to essentials, and contributed a short but vigorous introduction. G. R. C.

TRAVELS IN THE INTERIOR OF SOUTHERN AFRICA. By WILLIAM J. BURCHELL. Reprinted from the original edition of 1822–4, with some additional material and an introduction by I. Schapera. *London: The Batchworth Press*, 1953. 2 vols. 9½×6 *inches;* xxxii+381 *pages;* xviii+473 *pages; maps and illustrations.* 100*s*

This edition, limited to 1250 copies, once more makes available the work of an early traveller in Southern Africa who was not only an accomplished botanist but a careful observer whose well-written narrative can be read with pleasure. The book, which is in the form of a diary, describes Cape Colony and the country beyond it to the north as it was in the early years of the nineteenth century. Though botanical and zoological observations form an important part of the book (Burchell brought home 63,000 specimens), the descriptions of the visible and easily recordable aspects of African life are of considerable value in the study of South African material culture.

Burchell was born in 1781, and spent the years 1805 to 1810 on St. Helena as a schoolmaster under the East India Company. Here he met General Janssen, the last Dutch governor of the Cape, and Dr. Lichtenstein, from whom he received letters of introduction which led to his visit to South Africa. He spent the years 1810 to 1815 in South Africa, and from 1825 to 1829 travelled in Brazil. In 1834 Oxford gave him an honorary D.C.L., and he died in 1863. After his death many of his botanical specimens and manuscripts were given to the Royal Botanical Gardens at Kew; and a number of animal and plant species have been named after him.

After a stay at Cape Town and a number of short journeys in the country round, Burchell set off for the north. He went by the Bokkeveld and Roggeveld through Bushman country to the Gariep (Orange) river, where he came into Hottentot country. He reached Klaarwater (Griquatown), where he stayed for a time, and from which he made visits to the Nu Gariep (Orange) and Ky Gariep (Vaal) rivers, returning to Klaarwater for another stay. Leaving Klaarwater again, he visited the kraal of Kaabi, a "Bushman captain," and the "village" of Graaff Reynet. Then he went northwards by way of Sensavan (Postmasburg) to Kuruman and the country of the Bachapin (BaTlhaping), at whose capital Litakun (Takoon) he stayed for some time.

The narrative is interspersed with descriptions of Bushman, Hottentot, and BaTlhaping life and customs, and at the end of Vol. 2 there is a long account of the "town of Litakun" and of the material culture and organization of the BaTlhaping. In describing what he saw, Burchell has given useful and valuable material. Where social and political organization are concerned however he failed, like many other travellers, to understand properly what he was dealing with. For the ethnologist one of the most interesting chapters (Vol. 2, xvii) is that which describes the town of Litakun. This, according to Burchell, dated from about 1806, having been transferred from the Kuruman river, this in turn having superseded a site on the Moshowa river about 1802. This last must be that to which Stow referred ('Native Races of South Africa,' p. 440) as

containing two to three thousand huts and stone cattle kraals. Burchell noted that the name Litakun meant "stone cattle pound"; and it is clear, since he does not mention stone construction, and also says that the name was transferred from the old site "though with less propriety," that by his time the BaTlhaping had given up building with stone.

The book gives an admirable picture of the state of the country, and Burchell's comments on its European inhabitants are both shrewd and just. He was also at pains to emphasize his careful writing. "In these pages," he says in his Preface, "modesty may read without fearing to meet with descriptions and allusions which might raise a blush upon her cheek. This is the more necessary to be stated in a preface, as books of travels, though professedly lying open to every class of readers, sometimes contain matter offensive to delicacy. . . . Such indelicacies will never be found in these volumes." The illustrations are an important part of the book; many of the plates are coloured reproductions of Burchell's sketches, and form a delightful collection which must rejoice the hearts of all who love the South African countryside. The same praise cannot be given to the two maps, which are extremely defective, as they do not show Burchell's route at all adequately, and give little help towards elucidating his narrative. It is a pity that his own map and the accompanying "Remarks" on it were not included, the more so as it is described as "large and detailed," showing South Africa as known in his time. Apart from this, Professor Schapera, the publishers, and the printers are to be congratulated on a good piece of work well done. G. W. B. H.

NORTH AMERICA

SOUTHAMPTON ISLAND. (Department of Mines and Technical Surveys, Canada: Geographical Branch, Memoir 1.) By J. BRIAN BIRD. *Ottawa: Queen's Printer and Controller of Stationery*, 1953. 9×6¼ *inches; 84 pages; maps and photographs.* 50 *cents*

In recent years the Government of Canada has been paying much attention to her Arctic islands and seas, using trained geographers for the field work. This memoir on Southampton Island, one of the largest of the islands, gives a clear account of the physical and human geography of the area which was previously little known except as regards the coasts. It was discovered by Button in 1613 and seen again by Bylot and Baffin in 1615, but neither seems to have penetrated the interior. A long period of neglect followed. Ships entering Hudson Bay passed to the south, out of sight of the island, until attempts at a North-west Passage brought it again into notice. Parry and Lyon and later Back added to the charts of this corner of the Arctic. Then in the nineteenth and twentieth centuries came an era of land work, Lyon, Munn and Manning crossing the interior. Now a thorough exploration by J. B. Bird and other geographers has made possible this detailed monograph. In physical geography the island is important as being a limestone plateau now free from ice, but perhaps its greatest interest is in its inhabitants. The Sadlermiut Eskimo used to inhabit the land sparsely before the white men came. They are now extinct through disease and some Aivilik Eskimo have been brought from Repulse Bay. Apart from a former whaling station, the only permanent white settlement is a Hudson's Bay Company post at Coral Harbour in the south. The extinct Sadlermuit Eskimo were of interest as showing the nearly extinct Thule culture as described by Mathiassen and not known elsewhere among the islands. It is to be hoped that further memoirs will be published on other lands by the Geographical Branch of the Department of Mines now under the direction of Dr. J. Wreford Watson. R. N. R. B.

CANADIAN REGIONS: a geography of Canada. Edited by DONALD F. PUTNAM. *London: J. M. Dent & Sons*, 1952. $9\frac{1}{4} \times 6\frac{1}{2}$ *inches;* x+601 *pages; maps, diagrams and illustrations.* 63*s*

This book is undoubtedly the most authoritative and useful advanced geography of Canada yet published. It summarizes in a competent, systematic and lucid manner the existing literature on the regional geography of Canada, together with some unpublished researches and much material resulting from the authors' observations.

Unlike Professor G. Taylor's 'Canada,' this book, as its title indicates, makes a purely regional approach, except for an introduction on the physical background and for three concluding chapters on production, commerce, and "national development." The book deals separately with the familiar divisions of Canada: Newfoundland; the Maritimes; Quebec; Southern Ontario; Northern Ontario; the Prairie Provinces; British Columbia; and the Northland, a welcome originality here being the separation of Northern and Southern Ontario. In each region separate consideration is given to (*a*) the physical background, with particular emphasis on soils and plant and animal geography, (*b*) the economic geography including the history of settlement, and (*c*) the "regions and cities." There is a detailed index, a large number of photographs and many sketch-maps, most of them either distribution maps of the various regions or town plans.

The book is a storehouse of information, often detailed and, so far as the reviewer has been able to test it, accurate, on the geography of Canada, especially on economic matters, soils, climate and settlements. Furthermore owing to the systematic arrangement of the book this information is easy of access. Three criticisms, which do not by any means destroy the usefulness of the book, suggest themselves.

(1) The drawing of the maps is uneven. Some are under-reduced (*e.g.* Fig. 16), some are obscured by unnecessary dark stipple or hatching (Fig. 159), some are difficult to read for other reasons (Figs. 122 and 169). A number of the photographs seem rather pointless, and little use is made of them in the text; some are not large nor clear enough (*e.g.* of the four pictures of glacial features forming Plate 50, only one in fact allows one to discern the feature it is meant to show).

(2) Occasional rather loose writing mars what is generally a careful book, *e.g.* "London lies in a little basin, flanked by glacial moraines, into which the rivers from the melting ice brought great quantities of sediment producing a rather smooth plain. Trenched by the Thames, it provides excellent, well-drained building sites."

(3) In common with a number of transatlantic textbooks this book succeeds in taking all the sting out of geography. The subject seems to be reduced to a series of facts, lucidly explained and strung together. No mental effort is necessary in reading it, and all those difficulties, whether of principle or of research, which confronted the authors when writing it are carefully concealed, glossed over or ignored. For example the chapter on Newfoundland has no reference to the long term economic problem of Newfoundland, and to the position in the Confederation of comparatively small and backward provinces such as this or the Maritimes. The French–English problem is dealt with in two short paragraphs in the final chapter. The result is that readers will still find it worth while to look at André Siegfried's 'Canada,' in spite of its age and comparative slightness, to stop gaps that this work scarcely even recognizes.

At the worst this method reduces geography to the gazetteer: for example, "WOODSTOCK (15,500) county seat of Oxford county, situated in the valley

of the South Branch of the Thames River, 25 miles east of London, is the centre of one of the most productive dairy districts of Ontario. It manufactures textiles, furniture, organs, fire-engines, machinery, tubing, flour and feeds; the gross value in 1947 was $25,000,000, with a net value of $10,000,000." This is an extreme example, but the general impression is undeniable that this is a thorough, careful and useful book, which however is devoid of purpose or message. A. F. M.

CENTRAL AND SOUTH AMERICA

THE IMPOSSIBLE ADVENTURE: Journey to the far Amazon. By ALAIN GHEERBRANT. *London: Victor Gollancz*, 1953. 8×5 *inches; 390 pages; maps and illustrations.* 16*s*

JIVARO: Among the head-shrinkers of the Amazon. By BERTRAND FLORNOY. *London: Elek*, 1953. 8½×5½ *inches; 224 pages; maps and illustrations.* 15*s*

MY AMAZON ADVENTURE. By SEBASTIAN SNOW. *London: Odhams Press*, 1953. 9×5½ *inches; 224 pages; map and illustrations.* 15*s*

South America still continues to call the adventurous and in 'The Impossible Adventure' it has given us a very fine piece of literature. Alain Gheerbrant is a Frenchman and a poet, who carried his capacity for sympathy and understanding into the heart of the forest. He, two other Frenchmen and a Colombian, relied only upon good humour and their ability to gain the confidence of the Indians for their safety amongst the tribes of the Orinoco and the Sierra Parima. They took with them records of Mozart (a "magic influence") and by so offering something of white man's culture as well as his merchandise they broke down the barriers separating them from the Indians. They were allowed to witness and record many of the intimate rites of the tribes they visited.

The expedition moved eastwards across the Colombian llanos, where they came upon ancient rock drawings of amazing perfection and complexity, and then northwards to the Vichada river, where they had a rather unnerving experience with Guahibo Indians. They went on to the Orinoco and the country of the Piaroas and were present at their rites of initiation. The mounting tension preceding this ceremony is brilliantly transmitted. Moving eastwards again they reached the Sierra Parima and the Maquitare Indians. They suffered a reverse, in which they lost their precious Piaroan recordings, but they finally reached a village high in the Sierra whose headman had met white people in Venezuela and hated them. This proud chief, who had killed at least one explorer trying to learn the secrets of his tribe, did not molest them, but he refused to guide the expedition across the Sierra and was relieved to see them leave.

Rather than return to the Orinoco this indomitable party struck through the neighbouring territory of the Guaharibos, who were regarded by the Maquitares as little better than savage beasts. They found that even these Indians responded as human beings. They pushed on, dragged their canoe over the crest of the Sierra, although they were weak with starvation, and at last reached tributaries of the Amazon. They missed the Kaserapais, said to be more savage than the Guaharibos, but just before reaching civilization, lost in a maze of rapids, they had to jettison much of the material they had so painfully won in order to escape alive. Their story is one of the most enthralling of recent times. Not one word or phrase is redundant and the narrative is often very moving. For these qualities to be present in a translation speaks very highly of both the author and the translator, Edward Fitzgerald.

Bertrand Flornoy's account of his travels amongst the Jivaro Indians of Ecuador and Peru is also fascinating. He, too, tried the effect of music upon

the Indians as a means of bridging the gap between the investigators and the investigated. He is a much more conventional explorer than Gheerbrant and his narrative does not reach the same high standard. It is also marred by curious spellings of familiar Indian words (such as Kitchua for Quechua), misspellings of Spanish words too numerous to be overlooked and an occasional clumsy English construction. Nevertheless, to Flornoy goes the renown of learning the full details of the process of head shrinking and the associated rites.

Sebastian Snow's account of his trip down the Marañon on a balsa raft has rather the ring of an old-fashioned story for boys. It is a pity that the author's evident courage was not blended with other talents or interests that would have given his account a value of its own. P. B.

THE PAMPAS AND THE ANDES. By W. T. BLAKE. *London: Cassell*, 1953. $8\frac{1}{4} \times 5\frac{1}{2}$ *inches;* xiii + 190 *pages; map and illustrations.* 21*s*

THE LAND OF THREE WORLDS. By EVERILD YOUNG, *London: Andrew Melrose*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 256 *pages; end-papers; map and illustrations.* 18*s*

Enthusiasm despite difficulties is a common feature of these two books on Latin America, a country still strange to most Englishmen.

The Blakes, both keen motorists, spent a three months' holiday touring five South American countries in a Standard Vanguard, overcoming transport, Customs and passport difficulties, and ignoring warnings about "impossible," poorly mapped roads. In his straightforward, ably-told 'The Pampas and the Andes,' Major Blake recalls magnificent scenery, queer local habits and different varieties of the Spanish languages met on the journey from Montevideo to noisy Buenos Aires, eastwards over the Andes to Santiago and Chile's fertile belt, up the sandy, rockstrewn Great North Road through flea-ridden Chañaral and the derelict mining towns of the Atacama desert to Bolivia's lofty La Paz in carnival. The travellers visited Lake Titicaca and the rather disappointing remains from the remote past at Tiahuanaco, to return through the Argentine, Uruguay and eastern Brazil to Rio de Janeiro.

Peru holds Everild Young spellbound. The thrill of travel in an antique land, among people little known or understood, is the keynote of her appealing 'The land of three worlds.' Peru is a land of wonders and fantasy, "where nature has deliberately piled extravagance on top of peculiarity," a paradise for this keen photographer. From Trujillo she travels through flowers to Lima, capital of this earthquake-suffering land. From the coastal belt she goes south to Arequipa and up to the high Sierra and the ancient Inca cities built without mortar; to Cuzco where, in the Temple to the Sun (long since a Dominican monastery) she sees the influences of the Spanish and Inca empires "so intermingled that the sensation was almost eerie"; to Machu Picchu and the Indian Easter fair at Pisac. Crossing the Andes, mountain sickness is brushed aside in wonder at the views; from the *montaña* of the eastern slopes, the Amazon and the uncharted jungle lure her on. With a few helpers of mixed race the lone *gringa* then goes down the Aguaytia to the Ucayali and Puccalpa on a home-made balsa raft, a journey as fraught with dangers as the trek back to civilization, and as shrouded in mystery for the reader of this book. L. R. W.

POLAR

THE FALKLAND ISLANDS DEPENDENCIES SURVEY: Scientific Reports Nos. 1–5. *London: Her Majesty's Stationery Office*, 1953. 12 × 9 *inches; maps and photographs, various lengths and prices*

The activities of the Falkland Islands Dependencies Survey which have been reported in this *Journal* from time to time, have now continued for nearly ten

years. The survey has throughout aimed at carrying out a large scientific programme, while at the same time looking after the political interests of Great Britain in the region. These political interests, best served by establishing the maximum number of bases, tended to deprive the scientific side of adequate finance at first, but the position has gradually improved. During 1950 a Scientific Bureau was established in London under the direction of Dr. V. E. Fuchs with responsibility for disposal of the large collections of specimens and for publication of scientific reports other than meteorology, hydrography and survey. The appearance of the first five reports of this series provides a welcome sign that the survey is now a complete and well balanced research organization.

In the first report Dr. Fuchs, as general editor, briefly outlines the organization and history of the different bases. In addition to describing the method of numbering specimens, and outlining the maps of the region produced by the Directorate of Colonial Surveys, an appendix lists some 75 publications relating to the Falkland Islands Dependencies Survey. About half are contributions to various scientific journals made by members of the survey after completion of their service, in the absence of a recognized channel of publication.

The second report by R. M. Laws, a member of the survey, shows how growth layers in the teeth of certain mammals can be used to determine individual ages. His main study has been made on the elephant seal at approximately the same time as similar work was done elsewhere. The method provides a ready means of checking that the stock of these seals in South Georgia is not being over exploited.

The remaining three reports have been produced by experts in particular fields who have examined the specimens brought back by the survey. In discussing 'The Upper Cretaceous Cephalopod Fauna of Graham Land' Dr. L. F. Spath describes five new genera as well as nineteen new species and varieties. This report now becomes the standard reference in this field replacing that of Kilian and Reboul (1909) based on the collections of the Swedish South Polar Expedition of 1901–3. The fourth report by Dr. L. R. Cox describes various fossils from Alexander I Island for the first time, which include Upper Jurassic and Lower Cretaceous forms which show affinities with South American types. In the fifth report B. J. Marples describes Fossil Penguins from the Mid-Tertiary of Seymour Island, which he states are similar to those of New Zealand and Australia.

The format of the reports is similar to that of 'Discovery Reports,' with clear print, spacious and well laid out pages, careful editing and good reproduction of diagrams and photographs. Examination of plates would however be easier if the descriptive text were printed, so that it was not necessary to turn the covering fly leaf each time for reference.

The arrival of yet another series which biologists and geologists in particular must watch may be questionable, but the scope and length of the papers is greater than most regular publications could finance. If subsequent authors can maintain the present standard, their value will be unquestioned.

G. DE Q. R.

THE FALKLAND ISLANDS TODAY. By FORREST MCWHAN. *Stirling: Stirling Tract Enterprise*, 1952. 6 × 4 *inches; 90 pages; map and photographs.* 5*s*

In general, knowledge of the Falkland Islands is restricted and distinctly vague. Their geographical situation, when it is known, suggests either an Antarctic landscape or the sheep farming campus of Argentina, and it is very difficult to imagine for oneself what are the conditions in this group of islands so well

known by name and so little known in fact. A land with no rivers, other than those of stone, and with scarcely a tree; a mean annual wind speed of 15 knots and winds of gale force one day in five; a total area of 4600 square miles and a population no bigger than that of an English village, *i.e.* 2250, half of whom live in Stanley, the capital—this is the country described by Mr. McWhan. His story becomes more and more absorbing as each facet of the life of the islands is described. It is a simple life and work is hard, but these conditions have produced a self-reliant, homely and, above all and whenever opportunity offers, a most hospitable people who love their farms and who would not change their life for another.

This book of less than ninety pages and with nine photographs describes briefly but adequately the town of Stanley and its life of business and government administration. There follows a descriptive tour of the farms on the islands, during which the whole cycle of the sheep farming industry is dealt with and finally there are some chapters on the government and economy, and the natural history of the Colony.

It is difficult for the casual visitor to the Islands to get a true cross-section of the life of the Falkland Islanders. The menfolk, as the women will testify, talk of nothing but sheep, and the womenfolk on the other hand talk of their recent or projected visits to England. This was the impression gained when the present writer visited the islands for a few months nearly twenty years ago. On that occasion one of his shipmates was a young missionary making his first visit to the Islands, and he it is who, after nineteen years of extensive travelling in and widespread study of the Falklands, has produced this little book of interesting information on what the Governor in his foreword calls "a little bit of Britain." A. S.

PHYSICAL AND ECONOMIC GEOGRAPHY

DYNAMICAL OCEANOGRAPHY. By J. PROUDMAN. *London: Methuen*, 1953. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 409 pages; diagrams.* 55*s*

Oceanographers, like geographers, have passed beyond the comparative or descriptive stage to ask how?, when? and why? as well as where? and this extension of the study of the sea is difficult because the water movements, which have a bearing on all events in the sea, are governed by processes that are very complex as well as reasonable. Oceanographers have had plenty of warning: a well-known geographer told them eighty years ago that few subjects have excited more interest and attention than oceanic circulation, yet few are in a more imperfect and unsatisfactory condition because the question is one which properly belongs to the domain of physics and mechanics whereas few physicists of note have given the subject special attention. Little has been done since then to make the subject attractive to mathematicians and physicists: they look upon it as geographical exploration or a minor adjunct to marine biology and fishery research, in which the problems seem to remain the same for ever, and never to be satisfactorily cleared up. Their approaches to it are inevitably discouraged by the absence of basic data of the kind they can use, and the absence of an adequate guide to such theoretical work as exists among the mass of qualitative reasoning which characterizes the literature.

Professor Proudman's book is the first comprehensive specialist approach to the subject in the English language, and it presents it in an orderly way which is likely to attract mathematicians and physicists. Most of today's physical oceanographers, recruited into the subject from chemistry, geology and geography, will not follow most of the arguments; and the fact that in such a systematic approach the emphasis must be more on type problems than actual

conditions in the sea must cause them some disappointment, but they have begun to find their problems so perplexing that they realize the need for a new approach and their welcome for the book will be sincere though subdued.

The book gives a concise account of what is known of the principles underlying the mixing of sea-water, generation of ocean currents, waves, water circulation, tides and seiches. There is an introduction at the beginning of each chapter sufficient to show its application to actual oceans and seas, and the theoretical relationships are compared with the results of observations wherever this is possible.

It is hardly a book for the general student, but little progress will be made in oceanography until more of the serious students of the subject have mastered its contents. G. E. R. D.

THE SKIN OF THE EARTH. By A. AUSTIN MILLER. *London: Methuen*, 1953. 9×5¾ *inches;* ix+198 *pages; maps and diagrams.* 21*s*

Coming as it does from an author whose distinguished accomplishments in the fields of geomorphology and climatology are widely known, the content of this book in the light of its title was mildly surprising. But Professor Austin Miller is also the head of an active and productive department of geography, under whose supervision the acquisition of the cartographical techniques proper to a geographical laboratory receives admirable emphasis. With this experience, under this title he has assembled and discussed in relatively brief compass a considerable variety of exercises centred round the theme of physical geography. Following his introductory chapter, we embark on a review of the knowledge that can be gained, from geological and relief maps, of what Professor Miller expresses with acceptable phrasing as "the anatomy of the skin of the earth"; and the well-tried methods of extracting that knowledge. The second half of the book treats of meteorological charts and diagrams of various kinds whose function he describes as showing the physiological state of the skin of the earth.

The result is not merely a handy collection of exercises which many University departments will find useful. In these days when the scope of university geography, like history, must be narrowed and deepened if we are to remain sane exponents of a worthy discipline, students exploring less familiar ground need to be reminded of appropriate methods. Historical geographers for example can gain much from a perusal of this book. Moreover, this reviewer sees no reason why intelligent sixth-formers should not be let loose on many of the exercises, more especially in climatology, for which the material is so palatably provided in tabulated form. This however raises the interesting question whether visual appreciation of three-dimensional landscape does not demand greater maturity than that required by the two-dimensional pattern. There is room for experiment here.

Confronted with such a very convenient and well-thought-out assemblage of data for plotting, some students may perhaps react against this pre-digested form. In this reviewer's opinion the actual quarrying of the data from the more sombre official publications, hateful though others find it, is good experience; it makes a form of exploration not without value. But Professor Miller does not fail to recognize this, *e.g.* on p. 144; and moreover he can reply that the examination, to quote but one of his exercises, of climatic discomfort in Australia based on data in Table 30 provides a valuable stimulus to further thought and discussion.

Printing and production are admirable; numerous maps, diagrams and tables no doubt contribute to the price, which some may find rather high by

English standards. Few points arise for criticism; on p. 134 the annual extreme range is not quite the same as the difference between the mean maximum in the hottest month and the mean minimum in the coldest; on p. 144 the Book of Normals is not the same as M.O. 407 and the former (M.O. 236) is regrettably out of print. It would be helpful to have the date of the weather map shown on Figure 45. In the title of chapter 5, section 3, "elimination" as a term will appear preferable to some readers in the light of its derivation. Many of the methods and associated exercises, for example those on multiple profiles and accumulated temperature, reflect Professor Miller's own work. Lastly, all geographers can profitably read his introductory chapter; analogy, he says, is a dangerous device, but the brilliance of the analogies he proceeds to use makes for one of the most attractive, if brief, expositions this reviewer has had the good fortune to read. G. M.

HISTORICAL AND GENERAL

MAPS AND THEIR MAKERS. By G. R. CRONE. *London: Hutchinson's University Library*, 1953. 7½×5 *inches;* xiv+181 *pages; maps.* 8*s* 6*d*

It is no easy task to sketch the history of map-making in a book of fewer than 200 pages. But Mr. Crone has managed to do so in this, the eighth volume appearing in the geography series of Hutchinson's University Library. 'Maps and their makers' fulfils well the expressed aim of the series to which it belongs, namely "to provide popular yet scholarly introductions for the benefit of the general reader, but more especially for the unprofessional student who wishes to pursue his chosen subject up to something like a University standard." Travellers and explorers, as well as undergraduate students, will find Mr. Crone's book a thoroughly readable and attractive introduction to a most fascinating field of study.

The history of cartography touches many subjects—astronomy, navigation, exploration, surveying, engraving, lithography, aerial photography—to name but a few. Mr. Crone has been forced, by limitation of space, to select rigorously. His selection is good and he has accomplished his declared aim—"to indicate the main stages of cartographic development to which many countries have contributed in turn." 'Maps and their Makers' is comprehensive. Each chapter could well be expanded into a separate volume. To some the treatment may appear too compressed. The words "space does not permit" re-echo through the book. The author whets our appetites and we finish the book wishing that he had had more space, so that he could have discussed at greater length some of the many topics that he introduces. However, the reader for whom the series is designed is shown how to pursue his studies further; each chapter is followed by a short bibliography.

The book begins with a discussion of the cartographical legacy of Greece and Rome and an account of the "maps" of Western Christendom during those centuries formerly regarded as the "Dark Ages." Then follows three chapters on the Portolan Chart, the Catalan world maps and the world maps of Fra Mauro and Martin Behaim. An account of the reconciling of the Ptolemaic tradition in map-making with the new facts brought back by Portuguese ship-masters during the era of the Great Discoveries leads on to the work of Mercator and the Dutch school of map-making. The sequence of events leads naturally to a chapter on French cartography in the seventeenth century and so across the Channel to Britain in the eighteenth century. Finally there is a chapter devoted to national Surveys and modern atlases; this chapter perhaps suffers most from limited space.

"The size and format of the series does not permit of extensive illustration." The absence of adequate illustration is a great weakness. True, there are seven maps illustrating the text but they are only outlines and have been redrawn in uniform style. Accordingly no idea of general changes in the style of map reproduction is given. The author is aware of the limitations of his illustrations. In an appendix he lists the more important volumes of reproductions of early maps and charts. But the absence of even one photographic reproduction is an undeniable weakness. Doubtless the editors and publishers would justify this omission on the grounds of cost but the present reviewer would have preferred one reproduction to seven line blocks! Although she agrees with the author that even "the best reproductions are no substitute for originals," the counsel to eschew all but originals is indeed "a counsel of perfection" and is an impracticable one for the majority of readers for whom the volume is designed. But leaving aside the question of illustration, 'Maps and their Makers' is an authoritative and attractive introduction to an almost unlimited field of enquiry. It should find a place on the bookshelves of every geographer as well as in every general library. E. M. J. C.

MANDEVILLE'S TRAVELS; texts and translations. By MALCOLM LETTS, F.S.A. 2 vols. (*Hakluyt Society, Second Series, Nos.* CI *and* CII.) *London: Hakluyt Society, Bernard Quaritch*, 1953. 9 × 5¾ *inches;* liv, 1–224; xii, 225–554 *pages; plates and maps.* 80s

Though Sir John Mandeville and his Travels have intrigued scholars for a century, they still present problems to be solved. Mr. Letts's contribution, the first by an English scholar for many years, apart from his own biography of the 'traveller,' is to make available several important texts. Here for the first time is an accessible edition of the Egerton text, the sole complete English text (early fifteenth century), previously available only in the limited edition by Sir George Warner for the Roxburghe Club, 1889. This is followed by the earliest known MS., which is written in French and dated 1371—the Paris text of the Bibliothèque Nationale. Though known to Yule and other scholars, this has not been printed before. For good measure, he adds another English version, the Bodleian (Rawl. D. 99), and a number of excerpts from other documents.

Mr. Letts uses Warner's version for the Egerton text, but has modernized it quite considerably, printing proper names in their modern form, correcting grammatical lapses, and inserting the equivalent of obsolete words in brackets. In places he might have been a little bolder in dealing with the Egerton text; for example "when the day and the night er bathe ylyke lang," transcribed as "when the day and the night are both alike long," would be more intelligibly rendered as "when day and night are of equal length." Egerton is clearly a translation of a French text (but not the Paris text) made by a North Country man. The Paris and Bodleian texts are printed unaltered. The editor has provided the Egerton text with a comprehensive series of footnotes, mainly indicating the sources on which Mandeville drew, but also, as for the Paris text, giving variant readings. The place-names might have been treated a little more systematically. In Egerton, for example, we find "Rochays," not identified: in the Paris text it is "Reahiis," with a variant, "Roaiz," but, unless the reader consults the index, he will be unaware that the editor identifies it with Edessa.

The Paris text, apart from being the earliest known, is of interest as it establishes (until, perhaps, an earlier text is discovered) that the Travels were first written in French, but by an Englishman. It is also richer in geographical names than other texts, and there are corruptions which show that, despite its

early date, it is some removes from the original—evidence of the great popularity of the book. There is an interesting set of names on p. 379, which since there are few in Africa outside Egypt, deserved some comment. The suggestion may be hazarded that 'Belle Marin' here is a misunderstanding of 'Beni Marini,' a Moroccan tribal name, and, still less confidently, that 'Mont Plour' stands for 'Monts Clarus', *i.e.* the Atlas.

The more the Travels are studied the plainer it becomes that they are essentially a fourteenth-century textbook of geography, drawing on contemporary authorities such as Odoric, Haiton, Carpini and the famous letter of Prester John. This opinion is reinforced by the enlightening commentary on "the cosmographical ideas of Mandeville's day" which Professor E. G. R. Taylor contributes. This argues that the writer was a man of erudition, who had probably studied at the University of Paris. It is interesting to see also how the passages that have been held to indicate extensive foreign travel on the part of Mandeville are gradually being whittled away. The famous colloquy between Mandeville and the Sultan of Egypt is shown in the main to have been lifted from Caesarius of Heisterbach, a twelfth century writer.

Earlier writers, for reasons which cannot be detailed here, have held in fact that the Travels were the work of Jean de Bourgogne, a physician, who for some reason assumed Mandeville's name. The considerations set out above support the probability that the author was a scholar rather than a wandering knight, but Mr. Letts believes the reverse to be the case, and finds some strong arguments in these documents. Further, the main contemporary source of references to the Travels are the writings of one Jean d'Outremeuse, who claims that de Bourgogne revealed to him that he was really Mandeville. It may well be that a solution may be obtained through further research into the precise role of Outremeuse. As Mr. Letts says, "Mandeville students are used to surprises," and it is also possible that the Belgian scholars now collating all the French texts may add to the few established facts we possess about Sir John. Whatever the outcome, Mr. Letts has made a considerable contribution to the history of medieval ideas. G. R. C.

TRAVEL AND DISCOVERY IN THE RENAISSANCE, 1420–1620. By Boies Penrose. *Cambridge, Mass.: Harvard University Press*, 1952. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 369 *pages; maps and plates.* 32*s* 6*d*

Mr. Penrose's aim is to fill the gap in histories of exploration between Beazley's 'Dawn of modern geography' and Heawood's 'History of geographical discovery in the 17th and 18th centuries.' The period he covers is therefore approximately 1420–1620. To fit an account of the great age of discovery into reasonable limits requires a good deal of compression, but in addition he has also found room for chapters on the development of navigation and cartography. The author gives a straightforward account of the great voyagers without becoming involved in controversial aspects, and writes in an easy style, with an eye for picturesque detail. The chapters on cartography and navigation are useful summaries, though there are a few errors. The Contarini and Ruysch maps, for example, are not on a double-cordiform projection: four, not two, copies of Mercator's world-map of 1569 are extant; and the "decorative qualities" of Sylvanus' world map in the Venice Ptolemy are not very apparent.

The selective bibliography, extending to twenty pages, is useful, and there is also a short list of reproductions of early manuscript maps and planispheres. As a readable survey of the subject, the book can be recommended to student and general reader. G. R. C

THE MOUNTAIN WORLD 1953. Ed. MARCEL KURZ under the auspices of the Swiss Foundation for Alpine Research. *London: Allen and Unwin*, 1953. $6\frac{1}{2} \times 9\frac{1}{2}$ *inches; 220 pages; maps and plates.* 25*s*

The appearance in English for the first time of this (the eighth) edition of the Swiss Foundation's well-known annual, 'Berge der Welt,' is the first of a new series to be published in three languages, and is truly welcome.

Naturally priority is given to the articles on the 1952 expedition to Mount Everest, which are written by the several members of the team of gallant Swiss Alpinists who came so close to success. Each of the successive phases has been vividly described and each is interesting in itself. But over frequent repetition and failure to achieve a connected and continuous narrative make it somewhat difficult to gain a clear picture of an exploit remarkable in the annals of mountaineering.

In his personal contribution, "Mount Everest: a century of history," Marcel Kurz has given an excellent review of the history of the mountain, of the exploration of the approaches thereto and of the many attempts to reach the summit. But the desire expressed in the preface, for "disinterestedness regarding the nationality of one's own achievements," has been sadly disregarded in many of the comments, and it is only right to point out here certain omissions and inaccuracies. For instance, in addition to the daring air reconnaissance by Robert L. Scott in 1942, a New Zealand airman brought back, just after the war, some valuable photographs. The American expedition referred to on page 29 was ornithological, not botanical. The Lho La between Lingtren and Everest which is mentioned on pages 33 and 34 has retained that name up to now, but on the map on page 127 the South Col is shown as the Lho La. Even if the translation of the Tibetan name is correct the change in a work of this quality is not only confusing but untimely. The climbs in the Bolivian and in the Peruvian Andes by Hans Ertl, with Schroder, and by Piero Ghiglione with Anders Bolinder (of Sweden) provide good reading and the translations are first class; it may be remembered that Ertl was on Nanga Parbat with Herman Buhl. This section of 'Mountains of the World' furnishes an interesting contrast with the story of Everest and also a not unwelcome reminder that there are other high mountains than the Himalaya. Ertl's description of the ascent of Hancouma is almost an epic and he gives graceful and generous tribute to the Bolivian mountain troops who accompanied and assisted them. As Ghiglione points out "there is an immense field for the explorer and the mountaineer in southern Peru, with its quantity of virgin summits, many exceeding 20,000 feet in height.

The account of exploration in Greenland under Dr Erhard Fränkel affords food for thought in the comparison of the respective problems of Arctic mountaineering and those to be faced in other parts of the mountain world. There is also, in the earlier pages of this book a moving tribute, written by Othmar Gurtner, to the famous Swiss guide Gustav Hasler who died in 1952.

Throughout the photographs are magnificent and well reproduced. Special mention is due of the end panorama, from Taweche to Nuptse, which is as perfect as a photograph can be.

The book will be a joy to mountaineers who will be filled with admiration for the enterprise and fortitude of the men who took part in the various exploits described. H. W. T.

THE COAST OF INCENSE. By FREYA STARK. *London: John Murray*, 1953. $9 \times 5\frac{1}{2}$ *inches;* xiii + 287 *pages; map and photographs.* 25*s*

The third volume of Miss Freya Stark's autobiography follows the pattern of

'Beyond Euphrates'—a spare framework of narrative recapitulates the essentials already elaborated in her earlier books, and is reinforced by letters written at the time. 'The Coast of Incense' (1933 to 1939) covers the same ground as 'The Southern Gates of Arabia' and 'A Winter in Arabia,' and will send many readers back to these works to recapture an enchantment which is perhaps less immediately evident in Miss Stark's later writings. Is it that the author, in a too considered attempt to see her life and personality in the round, has robbed of significance those times when she is most truly herself, and thus blurs the highlights of her experience? In 'Traveller's Prelude,' perhaps because the story was so strange and the characters few and vivid, the thread of narrative led the reader straight through the labyrinth of events, marking each climacteric on the way. In the subsequent volumes, there is a tendency to smother such "moments of truth" in too great an accumulation of details—of illnesses, of personal relationships not fully explained, of isolated incidents not integrated with the general picture. Nevertheless, Miss Stark's life is well worth writing about, in whatever way she chooses to do it, embellished as always by her immaculate and limpid style. She must be allowed to make her own rules, for she is one of the great travellers (she holds a Gold Medal from the Society), a lone adventurer in countries of the mind as well as in the physical world, an irresistible force, above all intensely herself. Such writers will always be read. D. M.

AMENDMENT: 'American Indians in the Pacific' (*Geogr. J.* 119 (1953) 471)

In the Review Article "The theory behind the Kon-Tiki Expedition," our reviewer stated that no map of the Pacific was included in 'American Indians in the Pacific' by Thor Heyerdahl. The publishers, George Allen and Unwin Ltd., inform us that certain maps were not bound up in the first edition of the book, but sent out afterwards for incorporation in the first edition.

THE SOCIETY'S NEWS

THE MRS. PATRICK NESS AWARD

The President and Council announce the establishment of a new award for explorers and travellers through the generosity of Mrs. Patrick Ness, who has arranged that the first award shall be made in 1954. On 23 November 1953 Mrs. Ness placed at the disposal of the Royal Geographical Society the sum of £1300 to form a Trust Fund to endow an annual award either to travellers who have successfully carried out their plans or to encourage travellers who wish to pursue or follow up investigations which have been partially completed. Discretion is left to the Council if necessary to vary the terms of the award in such manner as may best conduce to the advance of geographical knowledge.

Mrs. Ness has herself travelled extensively, particularly in Africa, and has recorded her experiences in 'Ten thousand miles in two continents.' She has also shown her coloured films to the Society from time to time. She has been an enthusiastic supporter of the Expedition Fund and gave a generous donation towards the cost of the Norwegian–British–Swedish Antarctic Expedition 1949–52, of whose committee she was a member.

"SEVEN YEARS IN TIBET"

On 1 February 1954 Herr Heinrich Harrer addressed the Society on "Seven Years in Tibet," and this lecture was repeated in the course of the following week at Manchester, York, Sheffield, Bradford, Bristol and, finally, on February 7, at the Royal Festival Hall London. The lectures, held under the auspices of the Society, were open to the public; net proceeds from the sale of tickets went to the Society's Expedition Fund. Free places at the lectures were made available at centres outside London to Fellows of the Society and to Associate Members. This first attempt to add in this way to the amenities of those Fellows and Associate Members living beyond easy reach of the Society will be repeated, if successful, on future occasions.

'THE ASCENT OF EVEREST'

The Joint Himalayan Committee of the Royal Geographical Society and the Alpine Club have authorized two edited and abridged editions for school children of 'The Ascent of Everest' by Sir John Hunt (Hodder and Stoughton). The Senior Edition for children over 12 years of age and the Junior Edition for children under 12 are to be published shortly by the University of London Press, at prices in the region of 5*s* and 3*s* 6*d*. The two books have been prepared with the advice of Mr. Leonard Brooks, Honorary Treasurer of the Society, and will be fully illustrated with photographs, maps and diagrams.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Professor Frank Debenham is Emeritus Professor of Geography at Cambridge University, and has recently returned from making a special study of Lake Bangweulu and the surrounding country. *Mr. B. H. Farmer* is Director of Studies in Geography at Cambridge, and a University Lecturer; he was awarded the Gill Memorial prize by the Society in 1953. *Dr. W. R. Mead*, Lecturer in Geography at University College, London, specializes on Scandinavia and Finland; he has recently been giving particular attention to the incidence of ridge and furrow not only in his own sphere, but in this country and elsewhere. *Dr. G. P. Wibberley* is now Head of the Agricultural Economics Department of Wye College (University of London); from 1949 to 1953 he was in charge of a research unit in the Agricultural Land Service of the Ministry of Agriculture and Fisheries. *Miss Coleman* is a Lecturer in Geography at King's College, London; *Miss Ferrar* is an Assistant in the Society's Map Room.

UNIVERSITY NEWS

UNIVERSITY OF OXFORD

Professor Kenneth Mason retired last summer after twenty-one years' service in the University and is at present visiting Australia and New Zealand with his wife and daughter. He had seen the Honour School of Geography firmly established and has left behind him a large and growing department with a staff of ten full-time lecturers. He has been succeeded by E. W. Gilbert who was a student in the School in 1922 and 1923 and returned to Oxford in 1936 as Research Lecturer in Human Geography, becoming Reader in 1943.

Since the last notes appeared in the *Journal* several more colleges have appointed members of the staff of the School as Lecturers, and Miss M. M. Sweeting, appointed as a Lecturer in Geography by St. Hugh's College in 1951, has recently become a Common University Fund Lecturer. Pembroke College has joined Jesus and Hertford Colleges and St. Edmund Hall in awarding scholarships in geography.

Numbers in the School remain high and there are now 60, 69 and 54 undergraduates in the first, second and third years respectively. The number of research students has increased and the subjects being studied cover a wide range. Candidates have recently been accepted to work on topics of different kinds in Basutoland, Tunisia, Spitsbergen and the Antarctic. Recent graduates appointed to university posts include F. V. Emery (University College, Swansea), B. W. Hodder (University of Malaya) and D. N. McMaster (University College, Makerere). M. J. Webb has returned to the School as a Departmental Lecturer after two years as an assistant to Ian Bowen in the Department of Economics at University College, Hull. Miss E. M. Buxton has succeeded Mrs. A. H. W. Ward as Map Curator.

Field excursions were held in western Eire in 1952, when valuabie help was given by J. P. Haughton of Trinity College, Dublin, and in Normandy and Touraine in 1953. Members of the staff who have worked abroad in recent years include E. Paget in Sweden, C. G. Smith in Trieste and Greece, J. M. Houston in Spain and North Africa, and Miss Sweeting in Spitsbergen. R. W.

Steel was a member of the British delegation at a colonial conference in Florence and went to the International Geographical Congress in Washington in 1952, when he was Visiting Professor at the Harvard University Summer School. A. F. Martin attended the International Geological Congress in North Africa in 1952 and the Congress of the International Association for Quaternary Research in Italy in 1953. R. W. S

GEOGRAPHY IN AUSTRALIAN UNIVERSITIES

It is curious that in a country where the bushman, the student of the field sciences or history or sociology, and even the man in the pub, are all geographically-minded, the subject should be an academic laggard; and this despite the notable start given by Griffith Taylor. Since 1950, however, there have been encouraging advances.

Priority undoubtedly belongs to the Department of Geography at the University of Sydney, under the leadership of Professor J. Macdonald Holmes. Here the subject is taught as a full course for Pass, Honours, and higher degrees in the Faculties of Arts and of Science; and students doing three years' Economics for an Arts degree frequently take geography. Short courses are also planned in connection with Veterinary Science, Town and Country Planning, and Archaeology. Final Honours students act as technical assistants to the Professor and other members of the staff, and much work has been done in tropical Australia as well as in New South Wales; fieldwork is thus stressed, until in the fourth year some three months or more are spent in the field. Space forbids specific mention of numerous field projects.

Besides Professor Macdonald Holmes, the staff includes Dr. John Andrews (Senior Lecturer) and four Lecturers (W. D. Mackenzie, P. J. Devery, K. W. Robinson, D. S. Simonett), a Demonstrator, a Cartographer, and a Secretary. First-hand experience of New Zealand, some of the Pacific Islands, and parts of Asia facilitates studies in the Pacific realm.

The New England University College at Armidale is in process of becoming Australia's first country University, but meanwhile the geographical side of the work of the Department of Geology and Geography is under the wing of the Sydney Department. At Armidale E. W. R. Thorpe is Senior Lecturer and A. J. Rose Lecturer, and recent work includes studies of the Macleay floods and of the Queensland–N.S.W. border.

The other State Universities (in alphabetical order) are Adelaide, Melbourne, Queensland, Tasmania, and Western Australia. Of these Adelaide is at present the strongest geographically, with a Reader (G. H. Lawton), Lecturer Dr. K. W. Thomson), and two part-time Lecturers (Mrs. T. J. Marshall, Dr. A. Grenfell Price). Earlier geographical work was associated with the names of Charles Fenner (e.g. 'South Australia') and Grenfell Price ('White Settlers in the Tropics'). There is a three-year course in the Faculty of Arts and a one-year course in Economic Geography, mainly for students in the Faculty of Economics. Honours work has been begun. With the assistance of a grant from the Department of National Development, Canberra, a regional survey of part of the Adelaide Hills has been undertaken, and preliminary work has been done in the compilation of an Agricultural Atlas of South Australia. The Adelaide Department has strong links with Carl Sauer's school at the University of California, and is fortunate in being housed in the new Mawson Geological Laboratories.

At Melbourne there is no autonomous Department. Two courses, in Economic Geography, are offered in the Faculty of Economics and Commerce, and one in the Faculty of Science, though both are open to Arts students.

In the Commerce Department are two Senior Lecturers, Miss M. M. Bayne (working on Monsoonal Australia) and D. W. Fryer (south-east Asia, especially Indonesia): while E. J. Donath has done a good deal of work on Australian industry. In Science, A. A. Wilcock is working on Antarctic cartography and place names.

Courses in Economic Geography for Commerce degrees had been offered at the University of Queensland (St. Lucia, Brisbane) since 1924, but a Department was not established until 1950, when R. H. Greenwood came from the University of Otago to be Senior Lecturer. He has since been joined by Mr. A. D. Tweedie, also from Otago. A three-year course is now available for Arts and Commerce students, and an advanced Honours course should be launched next year. Mr. Greenwood's research covers the pattern of economic features in south-east Queensland; in connection with Mr. Tweedie's work on moisture problems in tropical and sub-tropical Australia, a Climate Recording Station equipped with evapotranspirometers has been set up at St. Lucia.

Tasmania is the youngest of the Departments, the Senior Lecturer-in-charge (Peter Scott) having taken up duties in October 1952; a Lecturer should be appointed shortly. A four-year Honours course in the Faculty of Science has been started, the first year of which may also be taken by Arts students: a full Arts course is under consideration, and there is also a long-established one-year course in Economic Geography in the Faculty of Commerce. Plans for a Geography building have been approved, and the beginnings have been made on a long-term research programme on land use in Tasmania.

As at Melbourne, Queensland and Tasmania, geography at the University of Western Australia (Nedlands, near Perth) has a long pre-history in connection with Commerce. Dr. J. Gentilli began the teaching of Economic Geography as a full annual unit in the Faculty of Arts in 1941, and in 1946 was appointed Lecturer; a part-time Tutor in Economic Geography (C. F. Makin) was appointed in 1951. At present courses are given in Physical Geography and in Economic and Social Geography; these courses are taken by students in the Faculties of Arts, Education and Science. Dr. Gentilli has published a good deal of work on climatology, agricultural geography and biogeography.

Finally, the new Australian National University at Canberra has a Professor (O. H. K. Spate), Reader (J. N. Jennings) and two Research Fellows (H. W. King, T. Langford-Smith) but rejoices so far in only two students. The University is purely a research institution, and work in progress includes studies in land use classification in Victoria, urbanism in south-eastern New South Wales, development in the Murrumbidgee valley, the regional geography of Kangaroo Island (South Australia), and coastal geomorphology on King Island (Bass Strait). Professor Spate has twice visited New Guinea since his appointment in 1951, and future plans include regional work in New Guinea and studies in the history of the cultural landscape in Australia. O. H. K. S.

UNIVERSITY GEOGRAPHICAL CONFERENCE

The Fourth Inter-Varsity Geographical Conference 1954, as briefly announced in the *Journal* for December 1953, is being held at Bedford College from 11–15 April; speakers will include Professors Manley, Wooldridge and Bowen. Excursions will be made to the Weald and through London by river steamer. The overall cost of the conference is estimated at 4½ guineas and application should be made through Departments of Geography. Members of 6th forms will be invited to attend morning lectures.

CONTRACTED EQUAL AREA PROJECTIONS[1]

A serious disadvantage of equal area pseudo-cylindrical projections[2] of the Mollweide and sinusoidal type is the distortion of angular values near the edges and poles of the projection. To overcome this defect, a number of projections on which the poles are represented by lines, usually half the length of the equator, have been devised.[3] On many of these, it has been found necessary to sacrifice the equal area properties of the projections in favour of this improvement in the representation of shapes.

Reduction of shearing may, however, be achieved without loss of equivalence by contracting a whole-sphere grid within the central portion of an equal area projection (where distortion of all kinds are relatively small), and spacing the parallels and meridians of the parent projection to form a new equal area net. It is suggested that such projections be called contracted projections.

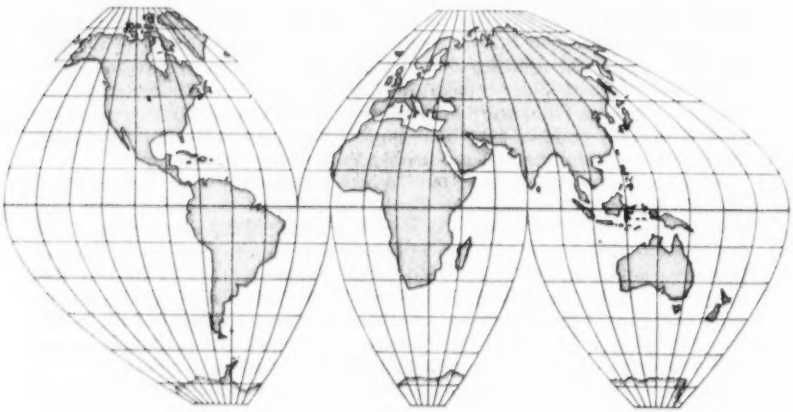

Figure 1

Figure 1, for instance, is a recentred 8/9 contracted sinusoidal projection, constructed on a sinusoidal net reduced in both north–south and east–west directions to 8/9 of its original dimensions, *i.e.* to 160° of latitude and 320° of

[1] The contracted projections were first discussed, and the name first suggested, in the writer's M.A. thesis in geography. See F. V. Botley, 'British and American World Map Projections from 1850 to 1950.' This is available at the Senate House Library, University of London.

[2] See J. E. E. Craster, "Some equal area projections of the sphere," *Geogr. J.* 74 (1929) 471.

[3] *E.g.* M. Eckert, "Neue Entwurfe für Erdkarten," *P.M.* 52 (1906) 97, and O. Winkel, "Neue Gradnetzkombinationen," *P.M.* 67 (1921) 248–52. Figures iv and vi on plate 24 (p. 248) of Winkel's paper are somewhat similar to Figures 1 and 2 of the present work, but they are neither recentred nor equal area, nor are they two of an infinite series. Similar projections to these have also been used in a number of American geographical works, *e.g.* E. C. Case and G. R. Bergsmark, 'College geography' (Wiley, New York, 1949).

longitude. The poles are represented by the 80° parallels of the original projection, and the new net is equal area.

This particular projection is but one of an infinite series of projections which may be constructed from the conventional equal area grids. The degree of contraction adopted may be anything between, say, 1/90 and 89/90, but the most useful series are those between 2/3 and 8/9. If the contraction is infinitesimally small, the cylindrical equal area projection results, whatever parent projection is used. All equal area contracted projections may therefore be regarded as means between the parent net and the cylindrical equal area projection.

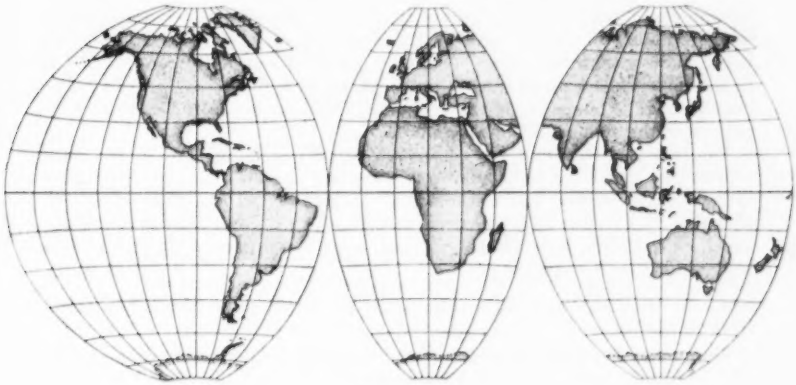

Figure 2.

Meridians and parallels of the parent projection are employed for the new net, but are numbered to make it equivalent. The parallels are spaced according to the formula $\sin \phi_p = \sin \phi \sin (90k^\circ)$

where ϕ = required parallel on contracted net
ϕ_p = equivalent parallel on parent projection
k = contraction, expressed as a fraction

Applying this formula to an 8/9 contraction, we obtain the following table:

8/9 *Contracted Projection*	*Parent Projection*
ϕ	ϕ_p
15°	14° 46′
30°	29° 30′
45°	44° 08′
60°	58° 32′
75°	72° 01′
90°	80° 00′

Equivalent meridians are calculated from the simple formula $\theta_p = \theta(k)$
where θ = required meridian on contracted projection, measured from the central meridian
θ_p = equivalent meridian on parent projection

Applying this to an 8/9 contraction, we obtain the following table:

θ	θ_p	θ	θ_p
15°	13° 20′	105°	93° 20′
30°	26° 40′	120°	106° 40′
45°	40° 00′	135°	120° 00′
60°	53° 20′	150°	133° 20′
75°	66° 40′	165°	146° 40′
90°	80° 00′	180°	160° 00′

To construct the contracted version of any conventional equal area projection, these equivalent values are plotted according to the formulae used in determining the coordinates of the normal projection, the resulting net being the 8/9 contracted form. A simple graphical method of construction is to interpolate them on to tracing paper placed over the parent net. In either case, it must be remembered that the scale of new net is reduced in direct proportion to the amount of contraction.

Figure 2 is a recentred 8/9 contracted Aitoff projection. This is the most satisfactory contracted projection from the point of view of the representation of continental shapes, but the unequal spacings of the meridians along the equator limits its use as a recentred projection: to prevent discordance along the equator of such projections, both northern and southern hemispheres must be recentred on the same meridians. F. V. B.

EARLY DEVELOPMENTS IN GEOGRAPHY AT MANCHESTER UNIVERSITY

The interesting obituary of John McFarlane in the *Journal* of June 1953 is not completely accurate in its suggestion that he was "the first lecturer in Political and Economic Geography at Manchester University": although McFarlane was the first to have this exact title, he was preceded by some distinguished teachers of the subject. With some of these developments the Royal Geographical Society as well as the Manchester Geographical Society were associated. The initial moves came in 1885, when the Manchester Geographical Society, inspired by the inquiries of Scott Keltie [1] for the Royal Geographical Society on geographical education, began a similar work in Lancashire. Early numbers of the *Journal* of the Manchester Geographical Society contain frequent references to education in geography. The Society's report (*M.G.S. Journal* 1 (1885) 310–42) includes a letter from the Principal of Owens College saying that "much of the instruction . . . in Geography should be given by the professors of history and geology, perhaps even by those of zoology and botany" but that a professor (or lecturer) should be appointed to coordinate this teaching, to lecture on the history of geographical discovery, to give brief "directory" lectures saying where information on commercial geography could be found, and to conduct examinations. He could also organize a map collection. In 1885, geography was taught at Owens College by geologists and historians; political geography was taught by historians, "physiography" by Professor Boyd Dawkins as a preface to geology and "the ancient geography of Britain" also by Boyd Dawkins; other teachers gave lectures on "the historical geography of England," and on "commerce and the colonies." The then professor of History, Dr. A. W. Ward, said that "a lectureship in geography, combining the physical and political sides of the subject might help to stimulate geographical study and research."

[1] *Supplementary Papers of the Royal Geographical Society*, (1888) 447–594. Keltie, J. Scott, Geographical Education, Report to the Council.

The first full-time teacher, H. Yule Oldham, M.A. (ob. 1951 aged 88) was appointed in 1892 (*M.G.S. Journal* 9 (1893) 58); his salary was paid by the Royal Geographical Society and the Manchester Society (whose contribution was £50 per annum). Mr. Oldham was appointed as lecturer in Political and Commercial Geography: he was succeeded in 1894 by Mr. A. J. Herbertson, M.A. (1865–1914). In 1895 it was reported that the salary was paid "in equal shares" by the two societies (*M.G.S. Journal* 12 (1896) 329). While in Manchester Herbertson gave ten lectures on the commercial geography of Asia and a lecture on "Edinburgh: a study of geographical cause and effect." Of this an abstract survives and may be found in Vol. 10 (1894) of the *Journal* of the Geographical Society of Manchester on page 385: it dealt with the origin of the city, first around the castle, later also around the Abbey at Holyrood, and with the fusion to make the Royal mile; and there was reference also to modern developments. This lecture was illustrated by "a collection of fine etchings of Edinburgh, geological and topographical maps, and a series of fine photographic slides, lent by Professor Geddes of Edinburgh" (*M.G.S. Journal* 11 (1895) 207).

Herbertson left in 1896 and no appointment was made for a year but Mr. A. W. Flux, M.A., came in 1897 to the lectureship, which he held in conjunction with the Cobden Lectureship in Political Economy; two years later Mr. Flux was given the chair of Political Economy and ceased to teach geography. At this stage, Mr. A. J. Sargent, M.A., was appointed but he resigned in 1902, and during the following session Professor S. J. Chapman, who had succeeded A. W. Flux in the chair of Political Economy, gave the teaching in geography. In 1903, John McFarlane came to Manchester, where he remained for sixteen years, and is still remembered with respect and affection by senior members of staff. For the first three years he was Lecturer in Economic and Political Geography and also held a lectureship in Economics, but in 1906 he ceased to teach economics and his title was changed to Lecturer in Geography. In March 1919 a readership was established but in September of that year McFarlane left for Aberdeen. T. W. F.

PROBLEMS OF WATER SUPPLY IN THE ARID AREAS

The paper by Dr. W. B. Fisher in the *Journal* for June 1953 very ably drew attention to the problem of water supply in Libya, a problem that has not adequately been appreciated in geographical studies of the arid areas of the globe. These arid areas have been neglected in many ways, for they are generally regarded as non-productive, or of so low productivity that they are of no interest in world affairs. Yet in general it may be said that the arid areas of Australia, the Middle East and southern and northern Africa are capable of producing healthy stock (Schoeller, 1937, 1941). The southern Kalahari is a very good example and the Sul do Save of Mocambique another. The problem of water supply is not insurmountable, since saline waters can be put to greater use than hitherto considered possible. A great deal of attention has been paid to such problems in South Australia, and the fact recognized that in any area unusable and usable waters can occur within a short distance of each other (Barnes, 1951; Keith Ward, 1946; Miles, 1952).

Nevertheless, in many cases areas have been condemned as useless because a number of boreholes have proved saline. For example, a recent survey I carried out in the low rainfall and formér desert area of the Sul do Save in Moçambique shows that over an area of about 2500 square kilometers, out of all the boreholes drilled to 30–40 metres, 24 per cent. are of low enough salinity for human consumption and a further 24 per cent. good enough for stock. Thus 48 per cent. of the boreholes are usable, a percentage that is very high for

southern Africa. And these conclusions are drawn from work on boreholes which have been drilled at intervals throughout the area, and without any geophysical work to assist. This raises the question of whether at least a partial development of these low rainfall areas can be achieved; and if so, what are the most economical methods. Recently His Excellency the Governor General, Captain Gabriel Texeira, and the Scientific Staff initiated a programme of investigation over the Sul do Save area, and this is being tackled by stages. A geological and geophysical survey is being carried out using seismic refraction, electrical and magnetic measurements where possible, as well as a drilling programme using small and large diameter drills. Geophysics alone cannot determine the quantity and quality of flow of underground water, but rapid delineation of structures is generally possible and this can be then advantageously followed by drilling holes of 1·5–2 inches diameter and when good potable water-flows are found, followed by 6-inch diameter holes.

Dr. Fisher raises two important points, the limits of potability and the observation by Dr. W. T. H. Williamson that the clay fraction in soils would seem to be the principal factor inducing salinity. A third important point is whether an initial flow of fresh water will be maintained; and also the converse —whether a salt water cannot be sweetened by continued pumping. Both phenomena in fact take place, but as far as I know there is no way of forecasting such events unless practical experiments are carried out (Cornet, 1952; Frommurze, 1931). Several years ago, Senhor J. Rodriquez Matins, in the course of work which ranged all over southern Moçambique, in the rocks which rest on the Lebombo Volcanics and which carry from Cretaceous in age to the Quarternary, found that saline waters were almost invariably associated with beds of clays or very clayey sands, or even limestones. The fresh waters in the Tertiary or Cretaceous of Moçambique, are almost invariably associated with beds of sandstone or grits. Conglomerates with a clayey matrix are also likely to give saline waters, often clays and clayey beds yielding water of greater salinity than sea water. The sandstones have a high seismic velocity and hence when thick enough can be located by seismic methods. Unfortunately many of the consolidated conglomerates have a much higher velocity. However as these are of limited extent in Mocambique the disadvantage is not as serious as it would otherwise be.

In Moçambique I have found that the waters of the lakes and rivers and in the laterites occurring at shallow depths are originally very fresh, and the salinity is therefore imparted later by the clays at depths of 20–40 metres; the surface and shallow underground waters in the laterites are either sufficient in flow or do not reach the lower clayey layers, so cannot reduce the salinity of the clay horizons. In South Africa, Dr. van der Merwe has shown in a soil survey that soils have a marked salinity when wetted with water. For example, rainwater has a resistivity of the order of 40,000 ohms per cm.^{2} per cm., indicating a very low total of solids in solution, but as van der Merwe shows in practically all his soil profiles, water of this purity when added to soils from various profiles, takes up salts in solution and rapidly falls to much lower values. Thus on page 259 of his paper, dealing with brown reddish ferruginous lateritic soils from the Transvaal, he quotes the following values:

Horizon	*Depth: inches*	*Resistance at* 60° F.
A	0– 6	1066
B_1	6–12	1200
B_2	12–24	1400
B_3	24–36	1300
B_4	26–47	660

In dealing with the desert soils (Chapter VI, page 21 onwards) he quotes values (page 34) for Beaufort West in the Cape Province as follows:

Horizon	*Depth: inches*	*Resistance at* 60° F.
A	0– 8	68
B_1	8–16	57
B_2	16–32	40
B_3	32–44	239

In these experiments van der Merwe added distilled water to samples from the various horizons, but it is clear that any horizon adds a quota of salts to the downward percolating waters and that the cumulative effect must be to have more or less saline waters at depths of 30–50 metres. This is in addition to any salt that may occur in originally marine sediments (van der Merwe, 1941).

I must stress that much of the Sul do Save has been a former marine (shallow water) area and subsequently has been covered by wind-blown desert sands and soils.

Work in the Kalahari, mainly in the south, has shown that Tertiary clays of fresh water environment impart a higher salinity to subterranean waters lying above a granite formation than is usually typical. In the southern Kalahari excellent and healthy stock-raising country occurs in areas of rainfall much less than 18 inches per annum, although the water supply is very difficult, except when dolomitic limestones are entered at depth, often as much as 100 metres. In the northern Kalahari and in southern Rhodesia, the basalt areas yield good flows of water at shallow depth, the water being weak in chloride, but high in sodium salts.

Dr. Fisher has raised the question of permanence of the flow, and it is interesting to note that du Toit (1939) reported many years ago that water is more readily found in the low rainfall areas of South Africa than in the high rainfall areas. I have found this to be true, with exceptions. The desert granite areas are invariably difficult as regards underground water, but basalts and sedimentary formations such as the Karroo and the more recent formations can yield very useful supplies of water.

Populations in such areas might thus be stabilized by water development and even increased. As the stock of such areas is usually very healthy, the potentialities of the semi-desert and desert areas are very much greater than they have been considered hitherto. The references at the end of this paper indicate the large amount of data on the whole problem. The question of infiltration rates to underground is a very difficult one in areas where there is no concentration of boreholes or wells. The values I have determined are for zones of medium rainfall, but of high evaporation, in the sand-covered areas the infiltration rates are much greater than these values. I do not consider that fossil water is of common occurrence, but small reservoirs underground are undoubtedly recharged over a matter of years, and can be depleted in a few months with extensive pumping. I base these conclusions on many leaching experiments and pumping results in the Orange Free State and southern Bechuanaland.

Finally, I would like to draw attention to two other important points, one raised by Dr. Fisher. Very useful surface water supplies are conserved in the Molopo River of southern Bechuanaland. The catchment area of the Molopo River has a very low run-off, of the order of 15 acre feet per square mile per annum, in contrast to the Orange Free State (for example) of 50–80 acre feet per square mile per annum. Here stock dams have maintained herds of two thousand cattle in southern Bechuanaland for as long as two years of drought,

that is, over three rainy seasons. Moreover, river-water in these low rainfall areas (or "Thirstlands" as Mr. E. J. Wayland calls them) can show little relation to underground water flows; and boreholes near the Limpopo (as near as 200 metres) can give salty waters. Old river courses containing alluvium can yield almost unpotable waters, as has been shown by wells in the old course of the Rio dos Elefants in Moçambique.

The maintenance of life in these areas is dependent on water supply, and the general problem of the location of underground water in arid zones is one that must receive increasing attention. In this respect, Mocambique is taking very active steps and I am grateful to the Government for their support. Engineer Martins da Silva, Director of Agricultural Services of Moçambique, has displayed a keen appreciation of the value of geophysical surveys in the development of the Sul do Save, where there are considerable water difficulties, and to him I am grateful for the many facilities that have been placed at my disposal, and for making use of my services.

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V. L. B.

THE STANDING CONFERENCE FOR LOCAL HISTORY

The Standing Conference for Local History, convened by the National Council of Social Service, held its Fifth Annual Conference on 16 December 1953, at Chaucer House, Malet Place, W.C.1 (by permission of the Library Association). Sir Stephen Tallents took the Chair.

Local history can only be fully understood in relation to the geographical background, and it is appropriate and useful that the Royal Geographical Society should be represented on this Conference. One of the more obvious ways in which Local History Societies can assist geographical study is in preserving old maps, printed and manuscript, and in making them known to students. Their value in reconstructing the historical geography of an area is considerable, provided their limitations are appreciated. Students of the evolution of Britain's coast line may well profit from contact with local antiquarians.

This last conference did not however yield much for the geographer. The morning session was addressed by the Earl of Euston on "The preservation of

churches and houses of historic or architectural interest"; after lunch, the conference split into two groups, one to listen to Mr. A. C. Edwards from the Essex Record Office discussing the study of local history in schools, while the other attended a talk by Mr. E. H. Sargeant, County Archivist of Worcestershire, on "A county photographic survey." The tea interval gave an opportunity to exchange news with delegates from different parts of the country—for instance, it was learnt that the Kent Local History Society is preparing an exhibition of old maps for next May.

In the evening Professor Jack Simmons (University College, Leicester) spoke on "The materials of local history"; the continual assembling of old records and manuscripts, said Professor Simmons, is increasing the number of sources from which a picture of the past can be drawn. Particularly, he drew attention to the fact that since the railways had been nationalized records previously divided among the different companies, and going back to the very earliest days of railway building, had now been collected by the British Transport Commission under one roof in London. D. M.

SURVEY OF NEW SOUTH WALES

In 1944, a Regional Boundaries Committee, appointed by the Government of New South Wales, divided the State into twenty regions for the purpose of survey, planning and decentralization. It was intended that each region should have "a broad measure of present economic and social unity and of community of interest." The Division of Reconstruction and Development, Sydney, are publishing preliminary Surveys of the resources of these regions. Two volumes recently received in the Society's Library deal with the New England region and the adjacent Namoi region. These two regions are primarily pastoral, producing between them nearly one-quarter of the State's wool production and one-third of the beef cattle. They are also areas of stationary or declining population, particularly in the rural districts. These reports give all available information on physical characteristics, economic activities and changes in population and service, but do not attempt to estimate the potentialities for future development. Each is accompanied by maps on the scale of 10 miles to 1 inch. Earlier reports received in the Library cover the Newcastle, Southern Tablelands, and the Manaro-South Coast regions.

WILLIAM CLOWES AND SONS LTD.

The 150th Anniversary of this famous old printing firm is an occasion for congratulation by the Royal Geographical Society, for Clowes have printed the *Journal* from its very first number. Dated 1832, Vol. 1 of the old series records the meeting of the Raleigh Travellers' Club on 24 May 1830, at the Thatched House, where the plans for a Geographical Society were first discussed. It is no coincidence that in a period which saw the founding and development of a number of learned societies, enterprising and high-minded printers like the first William Clowes should have prospered. The history of the firm is interesting: like many other men who have made their mark, the founder of the firm owed much to his mother; in his commemorative booklet, 'Family Business,' Mr. W. B. Clowes describes this ancestress as "a woman of fortitude and determination" who, left a widow at an early age, apprenticed her son to a printer. William left his native Chichester for London in 1802 when he was twenty-three, and on 21 October 1803 hung up his own sign at 20, Villiers Street. Since that date there has been no break in the family inheritance, and the firm has gone from strength to strength under the direction of successive generations of the Clowes family.

The firm's association with John Murray brought about their connection with the Society, whose archives contain many letters from the early days. It is interesting to note an estimate dated 7 December 1850 for the printing of an Arabic vocabulary, in view of the speciality developed by William Clowes and Sons towards the end of the century of stocking out-of-the-way foreign founts of type. Mr. W. B. Clowes reproduces in 'Family Business' an attractive set-up of hieroglyphics in 18 point, and one of 14 point Cree. This last calls to mind the great interest taken by the Society in the middle years of last century in this dialect, spoken by the Cree Indians and Eskimos round the Hudson Bay. The Cree alphabet was first cast in type at Clowes' works in Duke Street, on the south bank of the Thames.

The total destruction by enemy action of the Duke Street premises in 1941 has resulted in the transfer of all printing activity to the Caxton Works at Beccles, Suffolk, originally acquired in 1873. Today, relations between the Royal Geographical Society and the fifth generation of the Clowes family are close and cordial, and several members of the Society's staff were present at the cocktail party given by the firm on 21 October 1953 to celebrate the anniversary.

WEATHER IN SIERRA LEONE

Climatic statistics recently published in Freetown are of the greatest use to geographers making a serious study of Sierra Leone (*Statistics Illustrating the Climate of Sierra Leone*, Freetown, 1952). It is possible, from a study of these

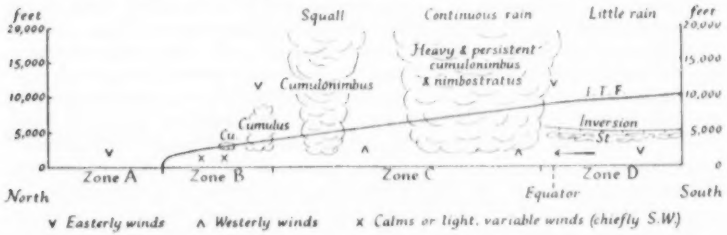

Fig. 1. Zonal diagram. (The trade wind inversion in Zone D is well marked, but it is not clear what happens to it in Zone C. It is not so prominent a feature for it is consistently punctured. Southwards Zone D will give place to the trade wind weather of the southern hemisphere.)

pages, to arrive at a fairly clear picture of the climate of this part of West Africa, where five distinct weather types, designated A–D in the Zonal Diagram, Figure 1, are recognized.

Harmattan weather (Zone A) occurs when the Inter-tropical Front lies to the south of Sierre Leone, as it occasionally does in short spells from December to February, when the sky is clear, temperature ranges are at a maximum (Freetown, mean daily range January 9·6°, August 8·0°; Bonthe, 13·8° and 8·1°; Daru, 23·8° and 11·7°), and visibility is poor because of the well-known dust haze. As the I.T.F. moves a little to the north the Dry South-Westerly Regime (Zone B) is felt, when skies are still clear and temperature ranges still comparatively high but when humidity increases so that conditions may be oppressive. There is heavy dew at night. The depth of the S.W. monsoon air stream is less than 5000 feet, not enough to permit the development of large cumulus or heavy convectional storms. These conditions may be experienced any time between

December and February, on occasions when the harmattan is not felt, and are used in March and April, but with the moving of the I.T.F. even farther north at the end of April or in May, and the consequent thickening of the monsoon air stream to 5000 feet or more, very changeable weather makes its appearance characterized by S.W. or west winds, squalls and thunderstorms. The latter may be of local convectional origin, or they may arrive from the east in the form of the line-squalls which have been described elsewhere.[1] Visibility is good between the storms. This weather is normally experienced from late April or early May until June, and from late September until November or early December, the intervening period being largely taken up with the Rains, when the sky is normally overcast (often heavily so) with altostratus, stratus or nimbostratus, while the rain is fairly continuous and often very heavy. The S.W. monsoon is the dominant wind before which ragged low cloud scuds sometimes little above house top level, so that living conditions may be damp and uncomfortable. Temperatures drop a little at this season (Freetown monthly mean January 80·1°, May 81·5°, August 77·6°; Bonthe 80·1°, 81·7 and 76·6°; Daru 78·2°—a reflection of low minima—82·3°, and 77·0°) though, as we have seen, temperature ranges are small (Zone C).

Finally, most parts of Sierra Leone experience a "Little Dry Season" (Zone D) in July or August, though only in some parts of the south and S.E. is it a sufficiently regular feature to show in mean rainfall values.[2] (Figures in inches.)

Pujehun. 0·64; 0·23; 2·59; 6·00; 9·56; 15·63; 31·18; 25·94; 26·56; 13·89; 6·85; 2·50=Total 141·57
Average over eight years, 1943–50.

Yengema. 0·38; 0·78; 3·82; 6·33; 9·00; 11·12; 10·60; 16·16; 15·77; 11·49; 5·68; 1·55=Total 92·68
Average over fifteen years, 1936–50.

Such, then, are the main features of the annual march of the climate of Sierra Leone. It is, however, also possible to recognize a spatial distribution of climatic types over the Colony and Protectorate, four chief divisions being distinguished in the *Statistics*, to which the writer would add a fifth (see Fig. 2).

1. The Peninsula Area.
2. The remaining Coastal Areas (2a the wetter South).
3. The Midland Region of moderately low relief.
4. The Eastern Hill District.
5. The North-east.

1. The Peninsula Area. The chief feature of this area is the high proportion of rain which falls from July to September (66 per cent.), while absolute totals are also high—a reflection of the mountainous nature of the Peninsula (Hill Station 174·45 inches mean, Cline Town 138·12 inches, Regent 204·84 inches, Kongo Valley 223·07 inches). The greatest total recorded in any one year was 319·19 inches at Kongo Valley in 1945, while 123·90 inches have been recorded in one month at Guma (July 1946). The highest recorded fall in one day in Sierra Leone is 15·95 inches near Regent (Babadori Saddle) on 2 October 1946, closely followed by 15·93 inches at No. 2 River on 5 September 1947. Temperatures, as has already been indicated, are remarkably constant throughout

[1] *E.g.* R. Miller, "The climate of Nigeria." *Geography*, vol. xxxvii, 4, 1952.

[2] This Little Dry Season seems to occur as a result of a temperature inversion of the type remarked upon by P. R. Crowe in his valuable articles on Trade Wind Zones. See also 'A Pilot's primer of West African weather,' Air Ministry, London, 1944, p. 11.

the year (Freetown yearly mean 80·1°, absolute maximum 95°, absolute minimum 67°).

2. The remaining coastal areas, where a slightly lower proportion (61–66 per cent.) of the total annual precipitation occurs during the July–September quarter (see Pujehun figures above). Totals are lower than in region 1 (Rokupr 114·64 inches, Sembehun 120·15 inches), though there is a marked rise towards the south (Pujehun, Bonthe 154·64 inches, Sulima 170·58 inches). Tempera-

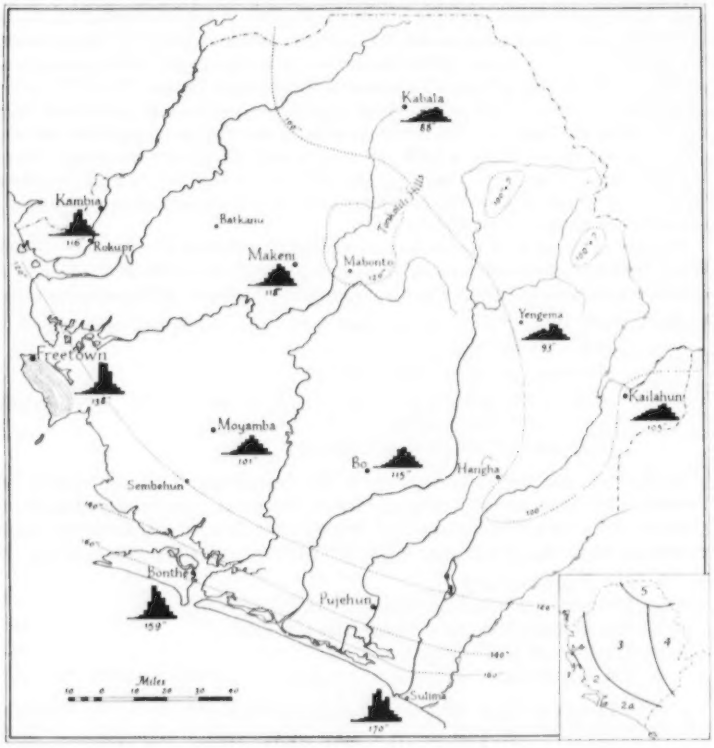

Fig. 2. Rainfall map

tures are not markedly different from those of the preceding region though a rather more extreme tendency is noticeable (Rokupr yearly mean 80·2°, absolute maximum 102°, absolute minimum 53°; Newton 78·9°, 98° and 59°; Pujehun yearly mean 80·8°, mean daily maximum 94·6°, mean daily minimum 68·7°).

3. The Midland Region, where 52–60 per cent. of the total rainfall occurs during the July–September quarter. Totals are on the whole a little lower than those in the previous region (Batkanu 106·27 inches; Hangha 104·12 inches; except in the Tonkolili District where falls of over 130 inches are probably the rule around the Tonkolili Hills (Mabonto 129·41 inches). Temperatures are

more variable and temperature ranges higher, though these variations are masked by mean figures (Makeni yearly mean 80·6°, absolute maximum 103°, absolute minimum 50°; Moyamba 79·6°, 100° and 53°).

4. The Eastern Highlands. The annual distribution of rainfall is more even in the east of the Protectorate, only 45–51 per cent. falling from July until September. An unexpected feature is that some parts of this region experience a little dry season in July. (Figures in inches.)

Yengema. 0·38; 0·78; 3·82; 6·33; 9·00; 11·12; 10·60; 16·16; 15·77; 11·49; 5·68; 1·55. Total=92·68.

Kailahun. 0·29; 1·08; 4·27; 6·65; 10·36; 12·39; 12·15; 17·24; 17·83; 13·96; 7·20; 1·76. Total=105·18.

Temperatures tend to be lower than in the previous areas, and ranges are often greater (Daru yearly mean 80·2°, absolute maximum 101°, absolute minimum 53°; Yengema 77·9°, 103° and 43°).

5. The North-east. Although the North-east is not specifically recognized in the *Statistics*, it is included here as it has certain well-marked characteristics; a combination of higher latitudes (9° 30 –10°), interior situation, and intermediate altitudes (generally over 1000 feet, and locally over 2000 feet) produces an approximation to the drier type of tropical climate, with lower rainfall (Kabala 88·36 inches) and lower mean temperatures (Kabala yearly mean 77·8°), together with a high temperature range (Kabala mean daily range 22·2°; *cp.* Freetown 9·5°, Makeni 19·3°, and Bonthe 12·0). This grassland (savannah) region, which seems to resemble Region 4 in its annual distribution of rainfall, is potentially perhaps one of the more important regions of Sierra Leone, with its suitability for cattle rearing and mixed farming, millet and groundnuts, though as yet it is remote and little developed.

Note on diagrams

In compiling the Zonal Diagram (Fig. 1) the following authorities were consulted: R. Miller, "Climate of Nigeria," *Geography*, November 1952; P. R. Crowe, "Wind and weather in the Equatorial Zone," Institute of British Geographers, 1951; 'Statistics illustrating the climate of Sierra Leone,' Freetown, 1952; 'Weather of the Sierra Leone Peninsula,' Air Ministry, 1946; 'A pilot's primer of West African weather,' Air Ministry, 1944; 'Weather on the west coast of tropical Africa,' Air Ministry, 1947; Maurice A. Garbell, 'Tropical and equatorial meteorology,' London: Sir Isaac Pitman and Sons, 1947.

In the Rainfall Map (Fig, 2). the figures were taken from the 'Statistics' and the isohyets based on the study of the same book. H. R. J.

CORRECTIONS

EVEREST PICTURE: WRONG TITLE

It is regretted that the picture facing p. 396 in the *Journal* for December 1953 was titled wrongly. The picture is reproduced here with the correct caption.

Revised caption:

Lowe climbing from the South Col towards Camp IX (27,900 feet) in support of the second assault

"Tectonic Relief with illustrations from New Zealand" (*Geogr. J.* 119 (1953) 216). Professor C. A. Cotton has pointed out that an error has been introduced into the drawing of Figure 2 which illustrates his paper in the *Journal* for June 1953. The Editor offers his apologies to the author and readers of "Tectonic Relief," and is glad to print below a correct version of the diagram.

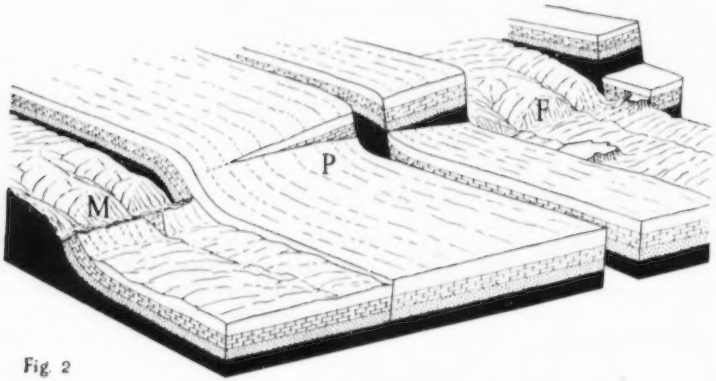

Fig. 2

NOTES

The Council of the AMERICAN GEOGRAPHICAL SOCIETY have appointed Mr. C. B. Hitchcock as Director in succession to Dr. G. H. T. Kimble, who has resigned. Mr. Hitchcock has been associated with the Society's 1/1Million Map of Hispanic America as head, since 1938, of the Department of Hispanic Research, and has also been the Society's Executive Secretary for the last three years.

* * *

The GEOGRAPHICAL ASSOCIATION celebrated its Diamond Jubilee on 26 September 1953 at its headquarters at Sheffield. The R.G.S. was represented by the President, Mr. J. M. Wordie, and Mr. L. Brooks, who presented an address of congratulations. A full account of the proceedings is given in the Diamond Jubilee Issue of *Geography* for November 1953.

* * *

The ninetieth birthday of VLADIMIR AFANASIEVITCH OBRUCHEV, President of the Geographical Society of the U.S.S.R. since 1947 and Honorary Member of the R.G.S. since 1916, was celebrated by the publication in his honour of the September–October number, 1953, of the *Izvestia* of the All-Union Geographical Society (Leningrad). The number contains an article summarizing his explorations and researches, geographical and geological, in Central Asia and elsewhere since 1886.

* * *

The 'CALENDARIO ATLANTE DE AGOSTINI' for 1954 is the fiftieth annual issue of this useful reference book. Despite its size, $6\frac{1}{2} \times 3$ inches, it contains much

up-to-date statistical and other information on the countries of the world, and an atlas of thirty coloured plates. It is published by the well-known Instituto Geografico De Agostini, Novara, and edited by Professor L. Visintin.

* * *

THE GEOGRAPHICAL COMMITTEE OF THE POLISH ACADEMY OF SCIENCES AND THE POLISH GEOGRAPHICAL SOCIETY held a conference at Poznan in March 1953, to discuss work on the proposed 'Geography of Poland' by some nine geographers. Proposals were made for starting this work just after the war, by the former Polish Academy of Science, and under the direction of Professor Czyzewski, but difficulties were encountered in "methodology" and organization. The former Academy of Science, at Cracow, was replaced in 1952 by the present Polish Academy of Sciences, Warsaw. The 'Geography of Poland' is to consist of three parts: 1. Introduction, including sections on the history of Polish geography, the development of Polish cartography and the geographical position of Poland; Parts 2 and 3, the physical and economic geography of Poland. At the conference, a number of speakers stressed the importance of fully discussing and if necessary revising each part of the work before publication. So far, the work appears to be still in the planning stage.

OBITUARY

ROBERT ASHLEY BALDRY

1895–1952

Robert Ashley Baldry, who died suddenly on 29 July 1952, aged fifty-seven, had been a Fellow of the Society since 1925. He was an M.A. of Cambridge and a distinguished Fellow of the Geological Society. He was educated at Thetford Grammar School and went on to St. John's College, Cambridge, where he held both a College and a County Senior Scholarship. During the First World War he served in the Special Brigade, Royal Engineers, and was awarded the Belgian Croix de Guerre; returning to Cambridge, he studied geology for two years under Marr.

From 1921 until his retirement in 1947, Baldry was geologist, and eventually chief geologist, on the Lobitos Oilfields, Peru. He mapped a considerable part of the Tertiary beds, of great complexity, of north-west Peru, and in 1938 contributed to the *Quarterly Journal of the Geological Society* an authoritative paper on the complicated "unconformities" with enormous breccia sheets which, he contended, could be satisfactorily explained by intra-formational sliding of great masses of strata over each other, under gravity (*Q.J.G.S.* 94, 1938). Some years previously, Baldry and the author of this note had presented before the Geological Society a paper on the great breccia sheet, the Clay Bebble Bed, of Ecuador (*Q.J.G.S.* 81, 1925). Although the sheet was then ascribed to thrusting, it was this occurrence, germinating in Baldry's mind, which eventually led him to his theory.

In 1935, when Baldry was travelling to Huanta on the Mantaro River in the Andes, the driver of his car lost control; the car overturned and fell into the river 300 feet below. Baldry was badly injured, and though rescued from the torrent by an Indian boy, his health was seriously impaired. After his retirement he did no more geology, but devoted his time to Civil Defence work. At the time of his death he had been nominated as head of the Reconnaissance Branch at Ipswich. C. B. B.

JAMES FAIRGRIEVE

1870–1953

The death of James Fairgrieve, a Fellow of the Society for forty-six years, has removed from the contemporary scene one of the few remaining great pioneers of modern geography. Born in Scotland in 1870, son of a Scottish Presbyterian minister, he graduated at Aberystwyth in 1889, and then went with an exhibition to Jesus College, Oxford, to read mathematics. After several years of teaching in Scotland, at Kelso and Campbeltown, he moved to London, where he founded the New Southgate High School, and in 1907 became geography master at William Ellis School.

He had had no initial geographical training except, as he so often said, "through his own boot soles" when tramping his beloved Scottish hills, and it was not until he attended a part-time course at the London School of Economics and fell under the spell of Halford Mackinder that, again to use his own expression, "everything clicked into position." From then onwards, geography became his life's work.

From 1912, when he left the William Ellis School, to 1935, when Fairgrieve retired from his Readership at the University of London Institute of Education, his influence became world wide. He devoted himself wholeheartedly to his students and yet found time to attend and speak at innumerable meetings and conferences; to write his numerous books; to make films; to examine for several universities; to publish meteorological research; to hold many important positions in the University of London and the Geographical Association; and above all, to teach. Fairgrieve's perseverance and immense industry will be remembered by many. If any topic commended itself to him, he would pursue it to its logical conclusion, no matter what the cost, physically or mentally. Geography was to him not only a scientific but a human discipline, and to its study he brought his critically constructive and, above all, practical mind to bear. His philosophy led to the classroom and few people, if any, can hope to equal his supreme ability to put into practice his concept that children must be helped to develop by putting them into situations in which they want to learn. His own lessons, so well known to thousands of students all over the world, were astonishingly stimulating because he himself had the power to a remarkable degree of creating such situations. His ability to educate in the widest sense through the medium of geography was possible only by his accurate and sincere appreciation both of his subject and of his pupils and students. His delight in maintaining his contact with people over long periods of time and over great distances of space was yet another instance of his lasting interest in "human subjects."

It may be that Fairgrieve will be remembered by the majority of people as a teacher or as the author of 'Geography and World Power,' 'Geography in School,' and many other books, but it is certain that those who knew him well will also feel keenly the loss of a kind and sympathetic friend, and remember his vivid and penetrating mind and his indomitable spirit that overcame years of great physical suffering.

R. C. H.

EMMANUEL DE MARGERIE

1862–1953

Emmanuel de Margerie was a distinguished personality as well as a conspicuous researcher and contributor to the advancement of knowledge and

especially of understanding. Born in 1862, he has just died in Paris at the age of ninety-one.

His marked individualism led him to refuse to take the Baccalauréat, so he could not become a Docteur de Science, nor a member of a university staff in the regular way. Nevertheless he made for himself a great career as a field worker in geology and physical geography, and his kindly and cultured personality made its influence permeate geological thought far and wide, helping many colleagues in France, Britain and the lands of German speech, and, no doubt, elsewhere also. His 'Dislocation de l'écorce terrestre,' published in 1888, marked a major advance in knowledge.

Eduard Suess' famous 'Antlitz der erde,' appearing in 1885, seized de Margerie's generous imagination and led to years of work resulting in a unique tribute to Suess, a tribute, moreover, of a French scientist to a colleague of German speech and thus a very unusual contribution. The 'Antlitz' was translated, but, far more, it was expanded and illustrated from de Margerie's wide knowledge and wise judgment, yet always with proper reverence for the splendid original work. Some of us who studied the 'Antlitz' and then found the three great volumes of 'La face de la terre' (1897–1911) have kept a warm feeling of gratitude to de Margerie as well as to Suess. This work brought out de Margerie's remarkable gift of detailed remembrance. Often, when asked, he would tell a colleague to look up an article quoting from memory the title, date and journal and, at times the relevant sentences. He seemed to have read everything, in many languages, an unusual characteristic in French and British scientists. His 'Description tectonique du Jura Français,' published in 1936, led to his election as honorary professor at Strasbourg University at the age of seventy-five and he was shortly afterwards elected to the Académie des Sciences. He had already presided over the French geological society from 1899 to 1919, but his own country was not lavish in honours for him because he had refused to follow the beaten track. It is to the credit of Britain that de Margerie was awarded the Lyell Medal of the Geological Society in 1921, the Victoria Medal of the Royal Geographical Society in 1930 and foreign membership of the Royal Society in 1931. Those of us who had the privilege of accompanying him in the field will specially feel that we have lost one of the great masters in the interpretation of scenery, as well as a kindly, humble and humorous personality.

H. J. FLEURE

CORRESPONDENCE

SO-CALLED "DETERIORATION" AND THE USE OF OXYGEN AT HIGH ALTITUDES

Admirable otherwise though the Presidential Address, 1953, must be considered, I feel compelled to take issue with my old friend, Mr. Wordie, on two points in particular. I refer to his remarks on p. 263 in the *Journal* of September 1953, which has lately reached me.

It is claimed that, on earlier Everest Expeditions, the rate of climbing at great heights became extremely slow "due without doubt to the deterioration which always accompanied acclimatization." Whilst it has been common knowledge that acclimatization, and the rate of acquiring it, varies very much with the individual, the condition which Dr. Raymond Greene in 1933 first described as "deterioration" is much less determinable, and, in the opinion of

many who have climbed high, can be regarded as unproven and probably fictitious. The average healthy participant in earlier Everest and other high expeditions did not suffer permanent, or even temporary, deterioration in the generally accepted sense. Though there may have been evidence, as often there was, of loss of weight and of dilated hearts, these did not necessarily incapacitate many climbers from going high again, after a short rest at a lower camp. Most of us after going high have felt extraordinarily fit, and were often keen to do more, if circumstances had allowed. As our "M.O.", Dr. Hingston, in 1924 maintained, a dilated heart doesn't matter, the important thing is an elastic heart that returns (as everyone's did) to normal! So-called "deterioration," altogether overemphasized by some physiologists, if not an actual fiction of the imagination, can in practice be likened merely to a temporary "puffed" condition. Nor have any cases been reported of permanent ill-effects to those who have gone to extreme altitudes, and have felt temporarily exhausted thereby.

It should be emphasized that these remarks apply to experience at altitudes up to 27,000 feet, and even 28,000 feet; whilst on theoretical grounds such an eminent physiologist and mountaineer as Dr. A. M. Kellas, and others, have shown that the differences in adaptability of the individual at 28,000 feet and 29,000 feet are practically negligible. And confirmatory evidence would seem to come from the low-pressure chamber experiments of Dr. C. S. Houston, in "Operation Everest" at Pensacola Air Station, Florida, in 1945.

Closely allied to this conception of "deterioration" is the emphasis given by Mr. Wordie to the *necessity* for the use of oxygen at high altitudes, as evidenced in the final success on Everest. With the tempo of competition to reach the top unfortunately on the increase, one can only agree that Sir John Hunt was right in adopting an all-out oxygen attempt in his bid for success. But this success with oxygen does not carry with it any conviction that under optimum conditions, the summit cannot be attained without an oxygen supply. The amazing accomplishment of Hunt, Gregory, Lowe and Noyce in heavy porterage well above 27,000 feet, almost without oxygen, is an indication at least that they might have been capable under other circumstances of reaching the top. Added to this is the achievement of the party high on K2 last year, as well as Dr. Houston's confident opinion, expressed in a recent letter to me, that the summit can be attained by well-acclimatized men without oxygen equipment. It is this point which, in my opinion, is of the greatest importance for the future of high Himalayan ascents. All the added expense, and extra "bandobast," implied by oxygen should not be regarded by Himalayan expeditions, even on the highest yet unclimbed peaks, as necessary or even desirable. Finally, and in spite of what Mr. Wordie has said, however gallant the attempt by Finch and J. G. Bruce in 1922 (*not* 1924), their use of oxygen as a full-time measure from as low an altitude as 20,000 feet, which thereby inhibited all possibility of acclimatization, is surely to be strongly condemned, since, in the event of failure of the oxygen, its users are, and in the above instance nearly were, doomed men. We can go further and say that if such practice had been adopted by all high-climbing parties in the Himalaya, mountaineering and exploration in that great range would have suffered a serious deterent and set-back from its remarkable accomplishment, *without* oxygen, during the last thirty years.

N. E. Odell

Department of Geology,
University of Otago, Dunedin,
New Zealand,

30 *December* 1953.

Mr. J. M. Wordie writes:

I have read Professor Odell's letter about the Everest climb with the very greatest interest. I do not think however that his letter calls for any change in the opinions stated in the Presidential Address last June. There is no doubt that Professor Odell himself would have been one of the few climbers possibly able to reach the summit of Everest without oxygen, but he is the rare exception.

The question of the use of oxygen was much debated in 1951 and 1952 and the decision to rely on oxygen and to try and improve the various methods of oxygen supply was perhaps the most important decision reached by the Himalayan Committee in preparation for the 1953 expedition. It was felt that the ascent to the record height of 28,000 feet made by Lieutenant-General Norton and Mr. T. H. Somervell in 1922 without the use of oxygen was exceptional; and the result that oxygen was not prominent in Everest attempts after that date until Mr. Peter Lloyd's experiments in 1938 was unfortunate. So much had been learned however by 1951 that the use of oxygen as an aid to climbing had become inevitable.

As regards "deterioration," what was stated in the Presidential Address last June had been carefully checked, and the answer to Professor Odell's doubts will be found in the accounts of the climbers themselves. Moreover, precise physiological investigations have now been undertaken on the mountain itself. These were discussed at the Royal Society at their meeting on January 28, and will no doubt shortly be available.

February 1954

DEFINITION OF HISTORICAL GEOGRAPHY

I cannot think that Mr. Parker has really thought out his objection to my citation of J. N. L. Baker (*Geogr. J.* 118, 420; 119, 369–70). In the first place, my precise point was that the terms of reference ("the reconstruction of past geographies") were likely to be interpreted in too narrow a sense. How could this point be made except by examining an admittedly able contribution made within those terms of reference? Is not this the normal method of scientific discussion? I may be an unduly coarse-grained person, but I do not think there is anything "unfortunate" (Mr. Parker obviously means "unfair") in this, provided the normal good manners of debate are observed. And I do not think that I offended in this respect.

As a matter of fact, 'An historical geography of England' does on occasion go beyond the terms of reference as interpreted by Mr. Parker. I would refer him to Professor Wooldridge's chapter on "The Anglo-Saxon settlement"—by general consent not the least valuable chapter—and ask him to consider carefully its opening and its closing paragraphs.

Mr. Parker's antithesis, that to protest against "economic history plus maps" means a preference simply for "political history plus maps," is surely an unreal one. The geographical distribution of political allegiance is a geographical fact, whether or not we try to explain it by "geographical influences"; and any reconstruction which leaves it out is to that extent an inadequate reconstruction. And it should need no demonstration that in the geography of the past, as in that of the present, economic and political factors are intertwined.

Canberra, O. H. K. SPATE

11 *November* 1953

THE PHYSIOGRAPHY OF WESTERN AUSTRALIA

Bulletin 95 of The Geological Survey of Western Australia

J. T. JUTSON

A third edition of this work has been published by the Geological Survey of Western Australia.

I have no responsibility for this third edition, but I think it advisable to draw attention to and comment on certain differences between that edition and the second published in 1934 by the same Survey but prepared by me.

1. The text of the new edition practically agrees entirely with that of the second edition as indicated by the Government Geologist in his Prefatory Note.

2. The geological map is new and is an improvement on that of the second edition. The maps, as a whole, are better than those of the second edition and the same remark applies to some of the non-photographic text figures.

3. The re-drawing of most of the non-photographic text figures in the second edition has been accompanied by the alteration of some of them. Amongst those altered are figures 47 to 50, 96 and 101, and in consequence of the alterations it is possible that wrong conclusions may be drawn from them. Also in figure 101 the arrangement of the words on the figure itself and the use of the capital letter "R" in "rock" makes the description somewhat unintelligible.

4. Figures 114 and 115 in the second edition are reproductions of actual photographs of the pebbles they are intended to represent. In the third edition the figures bearing the same numbers show many lines which do not appear on the figures in the second edition and which the pebbles themselves do not bear. Unfortunately these lines may be taken as submitted evidence of wind corrasion.

5. The photographic figures in the second edition numbered 15, 29, 36, 42, 44, 134, 141, 142 and 143 have been superseded by others. These new photographs have practically the same captions (except figure 143 and to some extent figure 142) as those of the corresponding figures of the second edition and therefore (with the exceptions mentioned) purport to show the same characteristic features although of different scenes. In my opinion the new photographs on the whole do not illustrate their subjects so well as those of the second edition and some decidedly fail in that test.

6. The list of references at the end of the third edition has not been brought up to date.

7. Many of the photographs in the third edition I regard as poorly reproduced and consequently in my opinion such are of little or no value.

9 *Ivanhoe Parade*,
Ivanhoe, N.21, Victoria, Australia,

28 *July* 1953

MEETINGS: SESSION 1953–54

Meeting of 9 November 1953. The President in the Chair

Paper: Economic Developments in French and Spanish Morocco. By J. M Houston

Meeting of 16 November 1953. Mr. L. Brooks in the Chair

Film with commentary: Deserts of Arizona and California. By W. G. V. Balchin and N. Pye

Meeting of 23 November 1953. The President in the Chair

Elections to Fellowship: Rev. Robert Acheson; Captain John Stanley Agar; Godfrey G. B. Barango; Rev. Edward R. Barnard; Cyril Boxhall, M.B.E., B.A.; Rev. Felix V. A. Boyse; Sydney Maxwell Brown; Mrs. Gertrude M. Chambers; Robert M. Christopher; Miss Kathleen Connell; Captain Andrew P. Crosbie; Dr. Jose M. Cruxent; John P. G. Dowman; Hugo Arthur Dunn-Meynell; David Emmet; Isaac Sergius Ephson; Baroness Cynthia Fain; Christopher M. Fairclough; Brian Fawcett; Kenneth W. Foster; Dennis Edmund Fox; Rev. W. O. H. Garman; Mrs. A. E. Gerard; Walter Gideon; Richard Goddard, B.COMM.; Miss Mary Griffin, B.A.; Harold F. Griffiths; John Michael Gwyther; Desmond E. St. Aubyn Harney; Colin Harrower; Henry H. Hemming; Christopher F. Hemming; Ernest W. Bruce Hill; Sir Edmund Hillary, K.B.E.; Miss J. F. Holgate; Flight-Lieutenant J. L. Hunt, R.A.F.; Dr. John Hunter; Mrs. Mary C. Jack; Captain Hugh G. Jenks; Rev. Willard Jones, M.A.; Lewis Brandon King; Captain P. J. K. Kingsley-Heath; R. S. J. Klincke; Miss Ena V. Knight; Mrs. E. F. Lancaster; Miss E. Low; Lieutenant-Colonel Theodore O'D. Lumley, M.A.; Miss Joan C. McKenzie, M.A.; Mrs. Ann D. Mansfield; T. N. Marsh, B.A.; U. Hla Kin Maung; Stanley D. May; Rev. George Metcalfe, B.A.; Raymond John Mitchell; Richard H. Moll; Miss Ivy E. Muddle, B.SC.; Edward Neeter; Sir John F. Nicoll, K.C.M.G.; Efiong Eyo Okon; Thomas R. V. Parkin; Captain H. W. Parry; Rev. Paul B. Peterson; Mrs. Rosalind O. Pushong; Roland A. Ransome; Felix Reich; Mrs. Blanche E. Richardson; H. C. O. Rogers, M.A.; Dean S. Rugg; George S. Sandwith; Mrs. Helen Sandwith; Miss Hilary G. Sargeaunt; Robinson Scott; Frank A. S. Simpson, M.A.; John Peyto Slatter; Rev. Verne Leslie Smith; Flight-Lieutenant Richard Russell-Smith, R.A.F.; Frank R. Stedman; Shantilal R. Tanna; R. B. Williams-Thompson; Thomas Todd; Anatole Vassilissin, B.SC.; Andrew Suttie Walker; Captain Alan D. W. Walter; P. J. Wallace; Mrs Ada Pang Wang; Emmanuel N. Watson; Thomas B. Widdowson; Andrew M. Woodman; Colonel W. A. Platt; Horace James Cartwright; Miss Anne V. Harding; Donald Howbert Bates; Lieutenant-Commander W. L. Clark

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Paper: New Light on Livingstone's last journey. By Professor Frank Debenham

Meeting on 7 December 1953. Mr. L. Brooks in the Chair

Film with commentary: Journey in Spain. By John Chear

Meeting of 14 December 1953. The President in the Chair

Elections to Fellowship: Maurice Edward Adams; Ronald H. Atkins; Raymond S. Bacon; Arthur Frank Beckenham; C. C. W. Box-Grainger; John Buckman; Lady Phyllis M. Burn; Charles R. Caldwell; Louis Carrier; Richard Carrington; Miss Susan Chaplin; E. W. Classey; Malcolm H. A. Collingridge; S. C. Cousins; Miss Jean Dart; W. I. Edwards; Anthony John Evans; M. F. A. de C. Fernandes, B.A.; John A. Fisher; Miss Pauline J. Fry; Ronald James Harrap; Miss Ruth C. Harvey; Lieutenant-Colonel George James Humphries; Captain Oscar P. Jones; Anthony L. E. Kemp; Bryan W. Langlands; Miss Petra Leay; Ivor James Lewton; Gerard Francis Lloyd; Benjamin Mackay; Rev. R. M. McMillan, B.A.; Lady Theodor Markham; Frederick C. R. Martin; Alan Francis Moore; Dennis George Pape; John E. Pestell; Miss Jean H. Pond; Alan Sydney Prime; Eric Donald Pugh; Frank Alan Ranger; Major Horace K. Shepherd; Captain Ian Sparrow; Christopher M. Tatham; Hon. James Tennant; G. A. V. Ward; Alan Warrell, B.A.; Dr. Arthur Wal-Tak Woo; Aitchen K. Wu, PH.D.

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Election to Associate Membership: Miss Rhona Ball; Miss Anna Sylvia Causey; Miss Bridget M. Couch; Miss Avril Eades; Margaret Edwards; Miss Janet Rosemary Hampden; John A. Kohler; Angus G. Lunn; Colin H. Mattingly; J. G. Muckler; Leslie Arnold Tonkin

Paper: Inside Borneo. By Tom Harrisson

Meeting of 21 December 1953. The President in the Chair

Paper: Othere's northern voyage. By Professor Alan Ross

Meeting of 1 January 1954. The President in the Chair

Paper: The ascent of Everest and its significance. By T. D. Bourdillon and C. W. F. Noyce. Joint meeting with the Geographical Association and the Institute of British Geographers

Meeting of 11 January 1954. The President in the Chair

Elections to Fellowship: Geoffrey Allanson; Miss Patience Aspinall; Bernard Arthur Banks; Derek Brearley; Miss L. M. Budden, B.A.; Peter G. G. Chapman, B.A.; Michael D. I. Chisholm; Nicholas Ensor Combellack; Jeffrey Cooper; Armand Denis; Mrs. Michaela Denis, B.A.; Constancio F. X. Dias; C. Wallace Dierickx; James Melville Dinwiddie, M.A.; Arthur William Dix; P/O. William F. Douglas, R.A.F.; Rev. Arthur H. Downing; N. J. George, M.A.; Cecil Oscar Gordon; Arthur D. Grove; Dr. George W. Hoffman; Roy Howard; David F. Johnson; Ronald Stephen Jones; Wou Kiuan; Mrs. Joan D. B. Lacon; Mrs. Annie Perry; Donald R. Petterson, PH.D.; Miss Anne E. S. Quilliam; John B. E. Smith; P/O. John Broadhurst Smith, R.A.F.; I. Adrian W. Sparkes, M.A.; Graham Spry; Gordon S. Stanion; Rev. Samuel T. Stringer; Royston Tiller; Mrs. Lettice Joan Townend; Major J. W. Webber; Miss B. W. Williams; Peter Joseph Wood; Mrs. Mary Buchanan; Ghulam Haider Khan; Miss Anne Mildred Marsh; William D. G. Rees

Elections to Associate Membership: John Richard Battson; George Morris Davey; Adrienne Mary Dicks; Miss Patricia A. Harper; John Graham Howells; Miss Ann V. Rignall; Miss Angela M. Twyford; Miss Jane Burt

Paper: Among the tribes of Venezuela and Colombia. By Ross Salmon

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

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The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

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The Bye-Laws provide that a candidate for admission to the Fellowship of the Society must be proposed by a Fellow personally known to him and seconded by another Fellow. Further, that a candidate is not eligible until he (or she) is twenty-one years old, unless he holds a Commission in Her Majesty's Forces or he (or she) is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms can be obtained on application to the Director and Secretary.

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A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

Made and printed in Great Britain
for the Royal Geographical Society
by William Clowes & Sons, Ltd., Beccles
Entered as second class mail matter (5 January 1898) in the
New York Post Office, N.Y.